HYGIENE FOR NURSES

THE MACMILLAN COMPANY
NEW YORK · BOSTON · CHICAGO
SAN FRANCISCO

MACMILLAN & CO., LIMITED
LONDON · BOMBAY · CALCUTTA
MELBOURNE

THE MACMILLAN CO. OF CANADA, LTD.
TORONTO

HYGIENE FOR NURSES

BY

ISABEL McISAAC

AUTHOR OF "PRIMARY NURSING TECHNIQUE"

GRADUATE OF THE ILLINOIS TRAINING SCHOOL FOR NURSES; FORMERLY SUPERINTENDENT OF THE ILLINOIS TRAINING SCHOOL FOR NURSES; HONORARY MEMBER OF THE BRITISH MATRONS' COUNCIL; CHARTER MEMBER OF THE NURSES' ASSOCIATED ALUMNÆ OF THE UNITED STATES; MEMBER OF THE AMERICAN SOCIETY OF SUPERINTENDENTS OF TRAINING SCHOOLS FOR NURSES; A COLLABORATOR OF THE AMERICAN JOURNAL OF NURSING; A TRUSTEE OF MERCY HOSPITAL, BENTON HARBOR, MICHIGAN

New York
THE MACMILLAN COMPANY
1918

Set up and electrotyped. Published August, 1908. Reprinted August, 1910; November, 1911; October, 1912; October, 1913; June, December, 1914; July, 1915; January, July, October, 1916; February, October, 1917; January, 1918.

Norwood Press
J. S. Cushing Co. — Berwick & Smith Co.
Norwood, Mass., U.S.A.

To

THE MEMORY OF MY FIRST AND BEST
TEACHER OF HYGIENE
MY DEAR MOTHER

ACKNOWLEDGMENT

Acknowledgment is hereby made with thanks to the following publishers for their courtesy in granting especial permission to make quotations: Lea and Febiger, publishers of *Practical Hygiene* by Charles Harrington, M.D., and *Hygiene and Sanitation* by Seneca Egbert, A.M., M.D.; W. B. Saunders and Co., publishers of *The Principles of Hygiene* by D. H. Bergey, A.M., M.D., and *The Hygiene of Transmissible Diseases* by A. C. Abbott, M.D.; and to D. Appleton and Co., publishers of *Practical Dietetics* by W. Gilman Thompson, M.D. Copyright 1895, 1902, 1905.

Cranford Farm, June, 1908.

PREFACE FOR TEACHERS

The object of this compilation is to secure for the young nurse a text-book on hygiene which shall be practical and within the range of her daily work. The standard works upon the subject are written for medical students and practitioners, and embrace an immense amount of information beyond the comprehension of the young pupil nurse, but which she may read and study with profit when she is ready for it, the writer believing that the first-year nurse should be taught what she can assimilate and use, and not what her teachers may wish her to know on a subject when she graduates.

Necessarily many things are omitted, subjects, such as the effect of cooking upon food, which are taught elsewhere, and which every good teacher will teach in their proper relation to hygiene.

A considerable number of quotations are given, for two purposes: first to cite the authority of statements, and second to assist in establishing the early habit in young nurses of looking up references, which they are not inclined to do without help.

A number of authorities have been consulted, and out of the suggestions embodied in their writings the compiler has endeavored to embrace in this manual what is essential to the nurse as a beginner.

In the following outline for more advanced pupils the hygiene of venereal diseases has been stated in greater detail than the other subjects, as the topic is one which heretofore has been systematically avoided in most schools for nurses.

The revelations of the American Society of Sanitary and Moral Prophylaxis have brought teachers of nurses as well as the public at large to a strong realizing sense of the need of better instruction to nurses, not only for the protection of their patients, but for themselves.

Supplementary Work for More Advanced Pupils

1. Hygiene of Venereal Diseases:
   Gonorrhœa. Syphilis.
   Definitions.
   Symptoms.
   Dissemination.
   Modes of infection.
   Prophylaxis.
   State control.
   Instruction to parents.
   Instruction to children.
   Instruction to young men and women.
   Protection of nurses.
   Four lectures, each followed by a quiz.

   References:
   Abbott's Hygiene of Transmissible Diseases, p. 166.
   Venereal Prophylaxis, by Marion Craig Potter, M.D., American Journal of Nursing, February and March, 1907.
   Transactions of the American Society of Sanitary and Moral Prophylaxis for 1906.
   The Renewal of Life, by Miss Margaret W. Wooley. A popular explanation of the process of reproduction in plants and animals, designed for the assistance of parents and teachers in giving instruction to children.

The following subjects for further study may be carried out very profitably by assigning them two or three months in advance, requiring formal papers prepared, which shall be read by the writers and discussed by the class. Blackboard illustrations, charts, photographs, and stereopticon illustrations should be provided. Pupils should be required to cite all authorities consulted, and the class should take notes for later examination.

2. Systems of Water Supply in:
    Rome.
    New York.
    Quebec.
    Chicago.

   These cities afford an excellent variety, as the sources of supply are widely different.

   Four papers.

3. Sewage and Garbage:
    Constantinople.
    Havana before the American occupation.
    New York.
    Chicago.
    Small towns.
    Country.

   Four papers.

4. Food supply of large cities.
   Pure food laws:
    Federal.
    State and Municipal.
    Methods of Union Stock Yards, Chicago.
    Cold storage.
    Methods of transporting perishable food.
    Jewish food regulations.

   Four or five papers.

5. Building ordinances:
    Protection against fire, and other safeguards.
    Air space in factories, etc.
    Water supply.
    Toilet conveniences.
    Elevators.
    Special study in reference to hospitals.

   Three papers.

6. Quarantine Laws:
    National.
    State.
    City.
    House and room.
  Disposal of the dead:
    Cremation.
    Burial.
    At sea.
    Dead from infectious diseases.
    Transportation.
    Coroners' cases.
      Three papers.
7. The Work of the Anti-tuberculosis League.
8. Military and Naval Hygiene.

The following standard works upon Hygiene are especially recommended to the senior nurses in preparing these papers:

Practical Hygiene. By Charles Harrington, M.D.
Hygiene and Sanitation. By Seneca Egbert, A.M., M.D.
The Hygiene of Transmissible Diseases. By A. C. Abbott, M.D.
The Principles of Hygiene. By D. H. Bergey, A.M., M.D.
Practical Dietetics. By W. Gilman Thompson, M.D.

TABLE OF CONTENTS

CHAPTER VIII

CHAPTER IX

CHAPTER X

CHAPTER XI

CHAPTER XII

HYGIENE FOR NURSES

CHAPTER I

INTRODUCTION

The increasing knowledge of the importance of the prevention of disease makes the study of hygiene and sanitation one of the most valuable factors in the education of nurses, who may by their understanding of the conditions which preserve health or cause disease, render as effective assistance in the prevention as in the cure of the manifold ills which afflict mankind.

In the nursing care given to every patient, no matter how trivial his ailment, as much or more time is devoted to protecting him from further or other ills, than is given to the care intended for his cure. If he cuts his finger, the principal care is to avoid infection; the cut itself may be of no great importance, but the infection of the cut may be vital.

In nursing typhoid fever the minutest details are carried out to prevent the patient from reinfecting himself, and from becoming a source of infection to his neighbor; therefore we may truthfully say, that nursing is very largely the practice of hygiene and sanitation.

The range of hygiene has become so enormously increased and complex, that it is a part of every branch of medical science. It lies with the scientist to investigate and expound the principles of hygiene, but its daily practice, which is the foundation upon which the health of a community largely depends, must necessarily be relegated to the women of the household or hospital to carry out.

Men may provide pure water systems, good sewerage, clean streets and laws to govern them, but beyond that their control of hygienic conditions is limited, and it is upon the women we must depend for the wholesome food and surroundings which stand for good health.

Pure water and good drainage will not insure a household nor hospital against epidemics, which harbor dirty ice boxes, cellars stored with decaying fruit and vegetables, dirty kitchen sinks, drains, bath tubs, and water-closets, unclean beds, unwashed bodies and clothing, bad ventilation and food, and rooms crowded with useless decorations covered with dust.

The keynote of good health is cleanliness of person and surroundings, while the chief cause of disease is filth. The young nurse beginning the study of hygiene cannot fail to realize as she undertakes each subject of air, water, food, etc., that *cleanliness* is the most important phase of every topic. The consideration of cleanliness may be carried to such an extreme, that one may become a slave to the details of living in order to secure it, but for one illy balanced person thus in bondage, there are millions of lives sacrificed because of unclean habitations; nor is it all in the tenements of the poor that such filth exists, it may be found in many high places where the excuse of poverty and ignorance does not exist.

Every woman who receives the training of a nurse should feel in duty bound, not only to practice cleanliness. but to teach it as well.

CHAPTER II

SECTION I

FOOD

PREPARATORY READING: *Anatomy for Nurses*, Kimber, Chapters XIII, XIV, XV.

FOOD supplies the needs of the human body in five ways: —

"1. It is used to form all the tissues of the body.

"2. It is used to repair the waste of all the tissues.

"3. It is stored in the body for future use.

"4. It is consumed as fuel to maintain the constant temperature which the body must always possess in a state of health.

"5. It produces muscular and nervous energy." (Atwater.)

Composition of Food. — Food is usually divided chemically into 1. Proteids and albuminoids; 2. Carbohydrates; 3. Hydrocarbons or fats; 4. Salts, extractives, etc.

Each group has its own office in the body and all are necessary in due proportion for the nutrition of the body, although in time of need any one of the divisions may supply for either of the others temporarily.

"In general it may be said that the carbohydrates are used for the production of force, and that the fats are stored in the body and used as fuel. The proteids do all that can be done by the fats and carbohydrates and in addition form the basis of blood, muscles, and all the connective tissues." (Kimber.)

The proteids are the most important constituent of both animal and vegetable foods, and between the two classes there is little chemical difference, their nutritive value being about equal. They are present in variable amounts in all vegetable and animal tissue.

Taken in excess they cause diarrhœa and albuminuria (albumin in the urine), while a deficiency will cause loss of strength and greatly lessened resistance to disease.

The fats are found in both animal and vegetable foods such as the fat of meats, of milk, olive oil, and cotton seed oil.

The carbohydrates include the starches, sugars, and cellulose, being found most plentifully in the cereals, as wheat, oats, rye, barley, corn, in the legumes, as peas and beans, and in the various root foods, as potatoes.

The carbohydrates lessen the desire for fats and taken in excess cause a great increase of fatty tissue in the body, and produce indigestion.

Certain *organic acids* are found in foods and are a necessary constituent for nutrition; their exclusion causing scurvy. The two most important acids are citric and tartaric, the former found in lemons and oranges, and the latter mostly in grapes; lactic acid is found in milk; oxalic acid is found in spinach, tomatoes, strawberries, and rhubarb; acetic acid is the acid of vinegar; malic acid is found in apples, pears, and some other fruits.

The mineral elements of food include water, the chlorides, phosphates, sulphates, and other salts of sodium, potassium, and magnesium, besides some of the compounds of iron.

Chloride of sodium (common salt) is the most important, and deprived of it there is loss of weight of the body. The phosphates are necessary for the growth of bone, and to the nervous system; iron is needed for the hæmoglobin in the blood; deficiency of calcium and magnesium causes rickets.

Two thirds of the weight of the body is made up of *water*, and in consequence large quantities of fluid must be taken daily to take the place of that lost by the excretions.

A certain amount is necessarily taken in all forms of food and beverages such as tea, coffee, milk, and the alcoholic or non-alcoholic drinks, three quarts daily being required for an adult, more in hot weather or when engaged in hard labor. An excess of cold water taken with meals impairs digestion, but the effects of a deficiency of fluid are much more serious, inducing disorders of the kidneys and bladder.

The reserve forces of the body are stored in the form of glycogen and fatty tissue.

Some of the end-products of carbohydrate digestion are reconverted in the liver into glycogen, which is given out for heat and energy during the intervals between eating. Fothergill says, "The liver stores up from each meal so much glycogen, giving it off as required; otherwise life would be one long, dreary meal."

The fattv tissue is less available, and is called upon during prolonged deprivation from food.

"The *potential energy* of any food is measured by the amount of heat which can be obtained by its complete combustion, and is expressed in units or calories. . . .

"The amount of energy required to raise the temperature of a pound of water 1° F. has as a mechanical equivalent 772 units of work; that is to say, the same amount of energy will raise 772 pounds 1 foot." [1]

The combustion of carbohydrates and fats in the body is complete, but the proteids leave a residue of urea.

The amount of food necessary varies with the individual, the occupation, and the climate. In planning any dietary, not only the nutritive value but variety and individual taste need consideration; otherwise the appetite becomes impaired.

The constituents of the standard diets have been modified by the results of recent researches.

One writer says that the "American working man requires four ounces of proteids, two ounces of fats, and eighteen ounces of carbohydrates," which seems to be the proportion and quantities generally accepted by the best authorities.

In modifying the quantity to suit the individual it is essential that the proportion of 1 part nitrogen to 15 parts of carbon be maintained.

The amount of water needed varies from 70 to 100 fluid ounces daily, according to the climate, season, amount of work or exercise, and activity of the skin and kidneys.

The digestibility of food depends upon its nature, texture, hardness, and chemistry, as well as upon the quantity, whether mixed with other foods, thoroughness of mastication, and upon the condition of the digestive

[1] *Practical Hygiene,* Harrington.

organs of the individual. Animal food is considered somewhat more digestible than vegetable; the fat of meats less digestible than the lean, and the sugar and starch of vegetables capable of complete digestion *when properly cooked.*

Many years ago a Canadian workman named Alexis St. Martin received an injury to the stomach which would usually have proved fatal, but the man recovered, with an opening into the stomach which enabled Dr. Beaumont to make a series of experiments and observations upon the process of digestion, which have been of remarkable value.

It should be taken into consideration that the process of digestion, however, does not all take place in the stomach.

Dr. Beaumont's list of foods is arranged in the order of their digestibility as follows: "Rice, tripe, whipped eggs, sago, tapioca, barley, boiled milk, raw eggs, lamb, parsnips, roasted and baked potatoes, and fricasseed chicken are most easily digested in the order given — the rice disappearing from the stomach in one hour, and the fricasseed chicken in two and three-fourths hours.

"Beef, mutton, pork, oysters, butter, bread, veal, boiled and roasted fowls are rather less digestible — roast beef disappearing from the stomach in three hours and roast fowl in four hours. Salted beef and pork disappear in four and a quarter hours."

Chambers' list of the digestibility of foods is as follows: "Roast mutton, sweetbread, boiled chicken, venison, soft-boiled eggs, new toasted cheese, roast fowl, turkey, partridge and pheasant, lamb, wild duck, oysters, periwinkles, omelette, tripe, boiled sole, haddock, skate, trout, perch, roast beef, boiled beef, rump steak, roast veal, boiled veal, rabbit, salmon, mackerel, herring, pilchard, sprat, hard-boiled and fried eggs, pigeon, hare, duck, goose, fried fish, roast and boiled pork, heart, liver, kidneys, lobster, salted fish, crab."

The Necessity for a Mixed Diet. — It is conceded by the best authorities that a mixed diet is an absolute necessity for man.

While there is no doubt that a large number of persons suffer from an excess of animal food, observation proves that people who live upon a strictly vegetable diet "if required to exert themselves in any unusual way when food is deficient, they simply die. The reason is evident — they have been living upon their own tissues, and the small quantity of albuminous matter in grain is a long time in building them up again, so that for weeks or even months their muscles are in a state of atrophy." (Chambers.)

The Chinese and Japanese are often cited as proof to the contrary, but in both instances while living principally upon rice, their diet is supplemented by eggs, fish, pork, and chicken.

[1] Thompson writes, "Attempts have from time to time been made for economic reasons to furnish large bodies of laboring men with a purely vegetable diet; but this diet is found to defeat its own ends, in that the maximum of labor cannot be maintained by men who are fed exclusively on vegetable food, although some carbohydrates are necessary. It gradually induces a condition of muscular weakness and languor with disinclination for either physical or mental work. . . .

" A man cannot perform more actual muscular labor

[1] *Practical Dietetics*, Thompson.

upon an exclusive diet of animal food than of starchy food. He requires abundant animal food to replace the general wear and tear of muscular tissue, but the energy for muscular contraction is not derived from nitrogenous food, but from carbohydrates, the former being used to keep the muscles in a healthful state of equilibrium. He who is physically feeble and who lacks muscular power cannot restore that power by an exclusive nitrogenous diet. A man fed upon nitrogenous diet without vegetable food may not work as well in daily labor as when given a fair proportion of the latter; but on the other hand he is better fitted for sudden arduous exertion than are exclusive vegetable feeders.

"A mixed diet therefore is the only rational one for man."

Section II

Varieties of Food. *Animal foods.* — The flesh of the herbivorous animals, domestic and wild fowls, eggs, fish, and milk and its products are the sources from which men derive animal food. Except fish, the flesh of carnivorous animals is unpalatable, although in time of need the flesh of horses and dogs and even cats is consumed.

In France and Germany the flesh of horses and dogs may be seen in many markets because of the high prices of other meats.

During the siege of Paris in the Franco-Prussian war it is said that a thousand dogs and five thousand cats were eaten after the food supply became nearly exhausted.

The nutritive value of meat is due to the presence of the proteids, fats, and mineral salts, the carbohydrates existing only in very insignificant quantities. All meat contains some fat, the greater the amount the larger its nutritive value. Pork usually contains a much greater proportion of fat than beef, while veal and fowls have comparatively little.

The flesh of young animals is more tender and therefore more easily digested. Raw meat is more easily digested than cooked meat.

Meat which has been properly roasted or broiled is more easily digested than when boiled or fried. Except in individual cases beef is the easiest of digestion and pork the most difficult owing to its large proportion of fat.

With veal its digestibility varies greatly with the individual, some persons digesting it easily and others with the greatest difficulty. The white meat of fowls is more digestible than the dark. Ducks and geese are more difficult to digest than other fowls, while wild fowls are more easily digested than domestic. Sweetbreads are easily digested, while liver, kidneys, and heart cannot be digested by persons with faulty digestion. The red meats (beef, mutton, and venison) are often prohibited to rheumatic patients, and less often for those suffering from disorders of the stomach or kidneys or from nervous troubles; the white meats (veal, chicken, and young pig) and fish only being allowed, it being supposed that the red meats contain a larger amount of nitrogenous substance and are irritating to the kidneys.

Diseased Meat. — Egbert[1] states that the following meats should not be eaten: "1. The flesh of all animals dead of internal diseases, or which have been killed while suffering from such diseases, or animals killed by overdriving. 2. The flesh of animals with contagious dis-

[1] *Hygiene and Sanitation*, Egbert.

eases that may be transmitted to man. 3. The flesh of animals that have been poisoned. 4. The flesh of animals with severe infectious diseases as pyæmia, etc. 5. Flesh that contains parasites that may be transmitted to man. 6. All putrid flesh."

The diseases common in cattle which render them unfit for food are tuberculosis, pleuro-pneumonia, foot-and-mouth disease, anthrax, Texas cattle fever, and actinomycosis. In pigs the diseases are hog-cholera, tuberculosis, Trichina spiralis, anthrax, muco-enteritis, measles, and Cysticercus cellulosa.

Meat Inspection. — The inspection of meat differs greatly in different countries. In the United States the inspection is mostly under the Federal authorities, much of it being done in Chicago and Omaha, the great meat markets of the world. This, however, does not cover the quantities of meat consumed in the small towns and villages where the supply is local, and there can be no doubt but large amounts of diseased meats are eaten daily in all parts of the country. The inspection of meat is made both before and after the slaughtering of the animal, and includes observations upon the amount and condition of the fat, the consistency, color, and odor of the muscles, the condition of the bone marrow, lungs, kidneys, liver, spleen, and lymphatic glands.

The internal organs are examined for tumors, parasites, or suppuration, and the microscopical examinations are made principally for the detection of parasites such as trichina.

Evidences of tuberculosis are found in the lungs, pleura, or some of the lymphatic glands.

In the United States, as well as in most foreign countries, the meat of tubercular animals is sold without any declaration as to its nature as wholesome meat when the disease is localized.

Thorough cooking will destroy any parasites or disease germs contained in diseased meat.

Meat and Fish Poisoning. — Some of the putrefactive changes in meat and fish produce toxins (poisons) and ptomaines (poisons produced by bacteria) which cause the cases of meat and fish poisoning in man. These cases arise more frequently from canned meats and fish than from fresh food. Unlike the parasites these toxins are not destroyed by cooking. Harrington cites the case recorded by Panum, "who found that the poison of certain putrid meat retained its activity even after it had been boiled 11 hours." It is found that it is not the extent of the putrefaction which determines the gravity of the poison, but the nature of the bacteria which have caused the change in the meat; some of the most violent cases of poisoning are recorded when the meat showed neither by look nor odor that putrefaction had begun, and on the other hand some meats in the advanced stage of decay were found harmless.

Transmission of Diseases by Meat and Fish. — Harrington says that,[1] "Concerning the possibility of transmission of tuberculosis by eating diseased meat there is practically no evidence of value, but whatever danger there is, if any at all, is disposed of by thorough cooking, since thereby the bacillus is quickly killed."

Three different kinds of tapeworm have been found to have been taken by man with imperfectly cooked meat and fish.

[1] *Practical Hygiene*, Harrington.

The disease due to *Trichina spiralis* which is found only in pork, occurs very commonly in Germany where the practice of eating meats which have only been smoked or not cooked at all, is more frequent than in America.

Fatal infections through abrasions of the skin are not uncommon among those who handle the flesh of cattle dead from anthrax and some other diseases.

Numerous epidemics and individual cases of typhoid fever have been traced to oysters taken from water which had been contaminated with sewage.

Milk. — Milk is one of the most important foods as it contains all of the essential elements which go to make a complete food.

However, milk is such a good culture-medium that it is invaded by bacteria of all kinds, and speedily becomes a source of danger unless handled with the greatest care.

The bacteria found in milk may come from a diseased cow, an unclean cow in unclean surroundings, filthy methods of milking, or dirty utensils, or impure water.

To obtain pure milk it is therefore essential that the cow should be clean and healthy, the milker of cleanly habits, and all utensils kept perfectly clean.

The thickening or souring of milk is due to certain bacteria which produce lactic acid; while other bacteria cause the milk to decompose before it sours. If bacteria were not present milk would remain sweet indefinitely.

The bacteria of disease such as tuberculosis may come from the cow or have been conveyed to the milk.

The transmission of tuberculosis to man by means of infected milk is still open to some doubt, but there seems to be enough evidence to warrant the prohibition of selling milk from tubercular cows.

Cows often have a condition known as *garget*, an inflammation of the udder; milk from a cow thus afflicted causes intestinal disorders in infants and young children.

The most common diseases conveyed by milk are not, however, derived from the cow, but are due to the lack of cleanliness, or to bacteria conveyed to the milk by flies or other insects, or by vermin, or by the use of polluted water. These diseases are typhoid fever, diphtheria, scarlet fever, and cholera.

Numerous epidemics have been traced directly to the dairyman or some other dealers who have handled the milk before it reached the consumer.

Cases of milk poisoning, many of them fatal, are due to the presence of certain bacteria which are found in unclean milk, or milk cans, or ice-cream freezers.

The most important disease produced in this way is "cholera infantum, so common among infants who feed upon cow's milk in warm weather. It is easy to understand the nature of this disease when we remember the great number of bacteria in milk, especially in hot weather, and when we remember that the delicate organism of the infant will be thrown at once into disorder by slight amounts of poison which would have no appreciable effect upon the stronger adult. We can easily understand, further, how the disease readily yields to treatment if care is taken to sterilize the milk given to the patient." (Professor Conn.)

Any utensils used for storing milk should not be used for other purposes; they should be rinsed in cold water, scrubbed vigorously in hot soapsuds, scalded in clear, boiling water, wiped with clean, dry towels, and be kept standing upside down.

The use of preservatives in milk, such as salicylic acid, boracic acid, and formaldehyde, is forbidden by the laws of many states and cities, as they are detrimental to health.

The regulations regarding milk have greatly improved in cities in recent years, but much more needs to be done, especially in the country.

Cream is the fat of milk which rises to the surface upon cooling; and after separation from the milk is turned to butter by agitation.

Cream is a most agreeable and wholesome form of fat. It is sometimes substituted for cod-liver oil for tubercular patients, and is an important article of diet, when it is borne well, for the long-continued wasting diseases. The addition of limewater will often render cream more digestible.

Cheese is one of the products of milk which has been used for ages as an important article of food. It is made from the curds of cows' or goats' milk, and may be made from skimmed milk, the whole milk, or by the use of whole milk and cream. Cheese, like veal, may be easily digested by some individuals, and be highly indigestible to others.

Cheese poisoning is not unknown, caused by the action of certain bacteria which also invade milk, cream, and butter.

Fish as an article of diet vary in nutritive value and digestibility; eels, herring, and salmon contain the largest amount of fat, and consequently are the most nutritious, but are much less digestible than sole, flounders, or whiting. Pavy says that, "the whiting is the most delicate, tender, and easy of digestion of all fish."

Salted fish are less easy to digest than fresh fish.

Fish should always be eaten when perfectly fresh, the best test of freshness being the bright redness of the gills and the fullness of the eye.

Fish is often allowed to patients with Bright's disease and other disorders, when meat is forbidden.

The poison arising from decomposing fish is more violent and more often fatal than similar cases of meat poisoning.

There are some individuals who cannot eat fish of any kind without symptoms of poisoning, and others who must avoid only certain kinds, like shellfish which produce skin disorders such as *urticaria* (hives).

Lobsters, crabs, clams, shrimps, and oysters afford a wholesome diet when perfectly fresh.

Section III

The Vegetable Foods. — The cereals wheat, rye, barley, oats, corn, and rice are among the most important foods; all contain some proteids, a large proportion of carbohydrates, some fat, and phosphates.

Wheat contains the largest percentage of proteid material, and rice the least.

The large percentage of protein contained in the legumes — peas and beans — renders them a valuable source of nitrogenous food as they are both inexpensive.

The grinding breaks up the grain and starch granules, separates the indigestible parts, and renders the starch suitable for cooking.

Composition of the Cereals [1]

Cereal	No. of analyses	Nitrogenous substances	Fat	Nitrogen-free extractives	Cellulose	Ash	Nitrogen
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Wheat	1358	13.89	2.20	79.75	2.19	1.97	2.22
Rye, winter	173	12.48	1.77	81.04	1.78	2.06	2.00
Barley	766	11.24	1.93	77.24	4.95	2.42	1.79
Oats	377	12.13	4.99	66.41	10.58	3.29	1.94
Corn, flint	80	11.74	4.78	79.20	1.67	1.40	1.88
Rice	10	7.00	2.00	84.76	4.00	1.16	1.12

Composition of the Leguminosæ

	No. of analyses	Nitrogenous substances	Fat	Nitrogen-free extractives	Cellulose	Ash	Nitrogen
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Beans	63	29.26	1.68	55.86	8.06	3.13	4.68
Peas	72	26.39	1.39	61.21	5.68	2.68	4.30

Flour ground by the old process is softer and smoother than by the new roller-process.

Wheat flour should not be too white, as that shows a lack of gluten. "Good flour holds together in a mass when squeezed by the hand, and retains the impressions of the fingers, and even the marks of the skin much longer than poor flour; when made into a dough it is elastic, easy to be kneaded, will stay in a round puffy shape, and will take up a large amount of water,[2] while poor flour will be sticky, flatten or spread itself over the board, and will never seem stiff enough to be handled no matter how much flour is used." [3]

[1] *Principles of Hygiene,* Bergey.

[2] One third of its bulk is the rule for bread.

[3] *Boston Cook Book.* Mrs. Lincoln.

Flour of any kind should be kept in a dry place.

Besides white flour, Graham flour and entire wheat flour are made from wheat. Graham flour contains the entire grain, even the outside husk, while entire wheat flour contains all but the husk.

"Parenthetically, it may not be out of place to refer here to the absurd views maintained by a large part of the community as to the superiority from a hygienic standpoint of foods containing all of the constituents of the cereals from which they are prepared. It is difficult to understand how the nutritive value of any food can be increased by the retention of matters which are completely indigestible, and to a certain extent irritating to the digestive tract. It is argued that an all-wise Creator made wheat, for example, in the form in which we see it, and that it is not for us to attempt to improve it as we think by discarding the outer layers. But this sort of reasoning might be extended so as to favor the consumption of the peel of oranges, the bones of fish, the feathers of birds, and other innutritious and undesirable waste products."[1]

Bread. — Bread is one of the most important forms of food, and is the most generally used food known. Wheat, being the most nutritious cereal and containing gluten, is the best adapted to bread making.

Bread contains flour, water, and salt, although its flavor and nutritive value are improved by the addition of sugar, milk, and butter. Well-made bread containing a small amount of fat is nearly a complete food in itself, hence the name "the staff of life."

To render bread "light" and digestible yeast is added

[1] *Practical Hygiene,* Harrington.

to the other ingredients, the whole being kept in a temperature about 70° F. for several hours. The yeast acts upon the sugar and converts it into alcohol and carbonic acid gas, the latter by its expansion causing the bread to become porous and "rise."

If this process of fermentation is incomplete, the bread is heavy, and if continued too long the bread "sours" from the formation of lactic and acetic acids.

Good bread should be white, sweet, and spongy, with a tender crust.

Bread is more easily digested after twenty-four hours old.

Bread may acquire unwholesome properties by improper care. It should be removed from the tins and cooled upon a rack that the air may circulate upon all sides of the loaves. It should be kept in a closely covered earthen jar which should be used for no other purpose, and be washed and scalded between each baking. Damp, moldy bread may cause serious digestive disturbances.

Baking Powders. — In lieu of yeast, a variety of baking powders are used to "leaven" different kinds of bread, rolls, biscuit, griddle cakes, cookies, and other sweet cakes.

Many cooks make their own baking powder by using 1 part of bicarbonate of soda and 2 parts of cream of tartar, this combination being the basis of the so-called "cream of tartar" baking-powders.

The action of potassium acid tartrate (cream of tartar) upon sodium bicarbonate liberates carbonic acid gas (carbon dioxide).

The combination of bicarbonate of soda with sour milk is a common and wholesome "leaven," provided the soda is not used in excess, and is thoroughly sifted and blended with the dry ingredients before the sour milk is added, the amount used being governed by the degree of sourness of the milk.

The phosphatic baking powders are equally good and wholesome, and are much less expensive. Baking powders containing alum are universally condemned as injurious to health.

The vegetables afford little proteids and fats, but a large proportion of carbohydrates and the mineral salts, and give variety to our diet.

Vegetables may be divided into tubers, such as potatoes, sweet potatoes, and artichokes, all of which yield a large proportion of carbohydrates; the roots as carrots, radishes, beets, turnips, parsnips, which yield little nutriment and are chiefly valuable for their antiscorbutic (remedy or preventive of scurvy) properties.

The herbaceous vegetables such as lettuce, cabbage, celery, asparagus, onions, spinach, and leeks are also chiefly important on account of their mineral salts and of the variety they afford.

The tomato, cucumber, squash, pumpkin, and eggplant are really fruits used as vegetables; they contain about 90 per cent of water and are very poor in proteids, and contain about 8 or 9 per cent of carbohydrates.

In the use of uncooked vegetables such as lettuce, radishes, young onions, and celery, great care should be taken in cleaning them properly. The germs of infectious diseases, such as typhoid fever, are found in the various fertilizers used upon the soil, and vegetables washed in polluted water may also be a source of infection.

The farinaceous (prepared starch) **foods** are arrowroot, tapioca, cooked chestnuts, and sago, all easily digested and much used in diet for the sick.

Vegetable fats are derived from nuts, olives, and cotton seed.

Olive oil is the most valuable as well as palatable vegetable oil used for food. Pure olive oil is of a greenish yellow color. The adulteration of olive oil with cotton seed oil has been very common.

Nuts are very nutritious on account of their large proportion of fat, but are difficult to digest. The nuts most commonly used in the United States are peanuts, walnuts, hickory nuts, cocoanuts, almonds, and chestnuts. Peanuts contain less fat and more protein than any of the others. In Italy, France, and Spain, chestnuts are used in many cooked forms, very largely in bread, or simply roasted.

Fruits. — By fruits we generally understand the products which are sufficiently palatable to be used raw as desserts. They are chiefly valuable for their mineral salts.

Eaten when ripe, and in moderation, they are wholesome and easily digested; unripe or decayed fruit produces digestive disturbances of more or less violent character.

It is considered better to eat fruit early in the day, as at breakfast. Fresh fruit is better than dried or preserved fruit, but fruit in some form should form a part of the diet throughout the year.

Bananas and figs are the most nutritious fruits, both being staple articles of food in the countries where they grow.

Of the large number of berries used in the United States, cranberries and gooseberries are the only varieties which need cooking, and the addition of sugar to render them palatable.

Some persons are unable to eat strawberries, either by reason of the intestinal disturbance produced, or because of *urticaria* resulting.

Sugar for food is obtained from sugar cane, glucose from corn, dextrose or grape sugar and beet sugar; beet sugar being much used in Europe.

Maple sugar, made by boiling the sap of the maple tree, is probably made only in the United States, where it is used as molasses or as a confection rather than for general purposes.

Honey, which contains about 73 per cent of sugar, may be regarded as a vegetable product.

Mineral Food. — The mineral most important as an element of food is salt (chloride of sodium). It stimulates the flow of gastric juice, thus promoting digestion.

Vegetables are deficient in salts, and the addition of sodium chloride while cooking renders them more palatable and digestible. The phosphates, sulphates, and other salts of sodium, potassium, and magnesium are present in sufficient quantities in a mixed diet.

Beverages. — Besides water, the important non-alcoholic beverages are tea, coffee, milk, cocoa, chocolate, and the various carbonated drinks made by charging a mixture of fruit sirup, flavoring, and water with carbonic acid gas.

Of the various mineral waters there are alkaline and sulphur, besides the various purgative waters.

Tea, coffee, and cocoa have a mildly stimulating effect, producing what Egbert describes as a "sense of comfort." Used to excess they produce insomnia, indigestion, nervous irritability, and palpitation of the heart. Tea and coffee are not nutritious in themselves, but are made slightly so by the addition of cream and sugar.

Cocoa and chocolate contain a considerable amount of nutrition, but to some persons are not easily digested, especially chocolate.

Alcoholic beverages differ greatly in the amount of alcohol contained, from beer containing from 3 to 5 per cent, to brandy and whisky containing from 40 to 47 per cent of alcohol.

Bergey [1] states that "Physiologic experiments have demonstrated that the alcoholic beverages may be regarded as articles of food, not only on account of the quantity of alcohol present, but also on account of the extractives which they contain. They serve to stimulate the digestion, the circulation, and the nervous system. They also diminish the oxidation processes of the body and lower the temperature. Small amounts of alcohol may be taken daily in the food, and, according to Professor Atwater's experiments, these small amounts are oxidized in the system and are therefore a source of energy.

"The principal objection to the use of alcoholic beverages is the fact that their constant use tends to the acquirement of the drink habit. The constant use of large amounts of alcohol leads to grave derangement of health, and for this reason the use of alcoholic beverages is to be condemned, except under special conditions in disease where such a stimulant may be required."

[1] *Principles of Hygiene.*

Condiments include a large number of substances of no nutritive value in themselves, but used as flavoring. They enhance the value of other foods by rendering them more palatable.

Of the simple substances, the common are salt, pepper, vinegar, mustard, cloves, cinnamon, nutmeg, allspice (pimento), mace, lemon and orange juice and peel, and sage, besides an innumerable list of catsups, curries, and sauces compounded from a combination of many spices, with vinegar and fruit or vegetables.

The tendency in hot countries is toward the excessive use of "hot" spices and high seasoning which in time impairs digestion.

Section IV

Food Preservation and Adulteration. — By the preservation of food we understand a process whereby food may be kept for a certain length of time or indefinitely without putrefaction.

Since putrefaction is due to bacteria present in the atmosphere, it is necessary for the preservation of food to protect it in some way from these germs. Heat and moisture being favorable to the growth of bacteria, certain foods such as meats, milk, berries, tomatoes, and others containing much moisture rapidly decompose in hot weather.

There are four common methods of preserving food: —

1. Drying.
2. Exclusion of air (with and without heating).
3. Exposure to cold.
4. Treatment with chemical agents.

Drying. — Drying is a process more suitable for certain fruits and vegetables than for meat, as meat when dried becomes tough, unpalatable, and loses much of its digestibility.

Fish which have been previously salted lose less of their flavor and digestibility than meat.

Eggs and milk are also dried.

Drying may be accomplished by the sun or by artificial means. Drying in the sun is easily done in a dry, sunny climate, but is d fficult near the sea or large bodies of water.

Raisins, figs, and prunes are usually sun-dried, as Spain and California, where most of them grow, have both hot, dry climates; but in the more temperate climates, where large quantities of apples and peaches are dried for the market, artificial heat is employed, the fruit being usually called "evaporated" fruit.

The efficiency of the drying process depends upon the thoroughness with which it is done, and drying does not prevent the invasion of parasites.

Exclusion of air is accomplished in various ways: by immersing the food in oil or fat, as sardines; by coating with some impervious substance such as paraffin or varnish; or covering with dry salt or sawdust, as with eggs.

Meat and fish are frequently preserved by exposing them for many days to the smoke from wood ashes, which coagulates the outer surface, rendering it impermeable, and at the same time gives the food a peculiar flavor very palatable to most people. Meats and fish are usually put into a salt brine for some days before smoking.

Food is canned by packing it tightly in tin cans which are sealed except a pin hole, and then steamed for several hours until thoroughly cooked and sterilized, when the pin hole is soldered. This is the process used for canning meats, fruit, and vegetables for the markets, and when perfectly fresh food is used under cleanly methods the food is wholesome.

The danger from canned goods may be from the action of the tin and solder upon meats or acid fruits and vegetables; or from food which was not fresh nor clean, or from lack of cooking or defects in sealing.

All canned foods should be removed from the tins immediately when the can is opened, but this is unnecessary when glass cans are used.

Exposure to cold is effected either by freezing, or by putting the food into a refrigerating chamber with a temperature two or three degrees above the freezing point. Frozen food will keep indefinitely, but loses much of its flavor. By the use of refrigeration or "cold storage," as it is commonly known, fresh meat is transported from the United States, from New Zealand and South America to England and the Continent.

Properly done, meat and other foods are often kept perfectly for several months, but there is room for many technical flaws in the process, and unless properly inspected, much dangerous food may be thrown upon the market.

Chemical Preservation. — Salt and sugar are the oldest and least harmful of all chemical preservatives. It is said that the process of brine-salting fish is the oldest method of food preservation known. Both meat and fish lose some of their nutritive value and become less digestible when salted.

A long-continued diet of salt meat or fish is conducive to scurvy.

Sugar in a concentrated sirup is used to preserve fruits, and dry sugar is used with dried fruits. Vinegar acts as a preservative in pickling vegetables, fruits, and oysters.

The use of such antiseptics as boracic acid, salicylic acid, and formaldehyde in small quantities and as an occasional ingredient of a diet has not been found harmful, but their continued use cannot fail to be injurious to health. Laws have been enacted in many states to regulate the use of these anti eptics, particularly in milk and beer.

The adulteration of food in this and other countries reached an enormous extent before the passage of the Pure Food and Drugs Act by Congress, which went into effect January 1, 1907.

On January 1, 1908, one year after the law went into effect, Dr. Wiley, Chief of the Bureau of Chemistry, of the Department of Agriculture, reported that 95 per cent of all the manufacturers and dealers in foods, drugs, and beverages are now supplying pure articles, correctly labeled.

The extent to which the adulteration of food had been carried may be gathered from Bulletin 100, Bureau of Chemistry, Department of Agriculture, by W. D. Bigelow and Burton J. Howard, which is quoted as follows:—

"Since the middle of the last century the subject of food adulteration has attracted a constantly increasing amount of attention. In this country very little was done in this line until about 1880. In 1881 the Division of Chemistry began the study of food adulteration, and since then has given a great deal of time to the subject. Since 1898 the origin and place of manufacture of the foods studied by the Bureau have been carefully noted, and special attention has been given to imported foods.

"In 1883 the first practicable food-inspection law in the United States was enacted in Massachusetts. Since that time other States have enacted and enforced food laws until at the time of this writing (1906) twenty-five States are seriously attempting to regulate the character and quality of the foods sold in their markets. In three additional States laws relating to the purity of dairy products are enforced, and in several others a beginning has been made.

"Food legislation has received much attention abroad and the more highly civilized foreign countries have efficient food laws and enforce them rigidly. The subject of the purity of foods is more widely studied in the United States now than at any previous time. The people as a whole are better informed on the subject than ever before, and there is a constantly increasing demand for definite information. In response to a very large number of inquiries regarding the matter this bulletin has been prepared as a popular statement regarding the nature and extent of food adulteration, and includes simple tests by which the housekeeper or retail dealer may determine some of the more prevalent forms of adulteration practiced.

"The demand for information on this subject is now very general and, as is often the case when public interest is deeply aroused, there is an unfortunate tendency toward exaggeration which frequently amounts to sensationalism. Such an attitude is to be deplored, and unless it is checked must sooner or later react unfavorably. It is not unusual to speak of some of our typical foods as poisoned, and of food manufacturers as poisoners. Such characterizations are unfortunate and untrue. Deleterious substances are doubtless sometimes added to foods. At the same time the word 'poison' has a very strong and distinct significance and should not be applied to any of the substances ordinarily added to foods, except in the sense that they are harmful. The word 'poisoner' signifies a person who intentionally and deliberately administers an article intended to result fatally, or at least very disastrously to health.

"We do not for a moment admit that any manufacturer of foods adds to his products substances which he believes will be injurious to health. There is no reason for attributing such motives to so large and important a class of our citizens, and their business sagacity in other directions precludes the possibility of shortsightedness of so serious a nature. We cannot do less than assume that manufacturers who depend for their success upon the reputation of their brands will add nothing which they believe will make their products seriously detrimental to health. It is not to their interest to shorten the lives of their customers nor to impair their appetites. We must assume that they honestly believe the products they employ to be wholesome. Therefore, in judging of the wholesomeness of preservatives and other substances added in the preparation of foods, the subject must be treated in a conservative manner and no criminal or even dishonest motives attributed to those who differ with us on the subject.

"'ADULTERATION' DEFINED

" During recent years there has been a tendency to confuse the minds of many by an incorrect use of certain words frequently used in the discussion of foods. It is the policy of some manufacturers to limit the word 'adulterated' to foods to which have been added substances of lower value than the foods themselves with the intention of increasing the weight or volume. This limitation is certainly not justified by the English language nor by the facts, and such a restriction of the term is entirely unwarranted. The word 'adulterated' properly describes a food to which any noncondimental foreign substance, not properly constituting a portion of the food, has been added. The fact that the added substance may be at times of a greater commercial value than the food itself has no bearing on the question. Conversely, the word 'pure' is properly applicable to foods that are unmixed with any foreign substance. It may be wholesome or unwholesome, but this property is not indicated by the word 'pure' or 'adulterated.' This definition is not, of course, complete. According to the laws of many of the States a food is declared to be adulterated under the following conditions: —

"'First, if any substance or substances have been mixed with it, so as to lower or depreciate or injuriously affect its quality, strength, or purity; second, if any inferior or cheaper substance or substances have been substituted wholly or in part for it; third, if any valuable or necessary constituent or ingredient has been wholly or in part abstracted from it; fourth, if it is an imitation of or is sold under the name of another article; fifth, if it consists wholly or in part of a diseased, decomposed, putrid, infected, tainted, or rotten animal or vegetable substance or article, whether manufactured or not, or, in the case of milk, if it is the product of a diseased animal; sixth, if it is colored, coated, polished, or powdered, whereby damage or inferiority is concealed, or if by any means it is made to appear better or of greater value than it really is; seventh, if it contains any added substance or ingredient which is poisonous or injurious to health: *Provided*, That the provisions of this act shall not apply to mixtures or compounds recognized as ordinary articles or ingredients of articles of food, if each and every package sold or offered for sale bear the name and address of the manufacturer and be distinctly labeled under its own distinctive name and in a manner so as to plainly and correctly show that it is a mixture or compound, and is not in violation with definitions fourth and seventh of this section.'

"The claim is made by some manufacturers that the addition of a preservative to food does not properly constitute adulteration because the preservatives added are of greater commercial value than the foods themselves. Such a claim, however, seems to be nothing but a play upon words. For instance, benzoate of soda has a greater commercial value, weight for weight, than tomatoes, and the claim has been made that for that reason its addition to tomatoes actually increases the expense of the preparation of tomato catsup. As a matter of fact, however, it permits the tomato pulp to be prepared in large quantities and preserved in barrels in a much less expensive way than can be done without its use. It is evident, therefore, that even though the preservative employed is more expensive than the substance to which it is added, the addition is really made for the purpose of cheapening the product. It is not for this reason that such a substance is properly called an adulterant, however, but because it is an added foreign substance and is neither a food nor a condiment. These definitions cannot be emphasized too strongly. Adulterated foods are not necessarily unwholesome foods.

"The term 'misbranded' is appropriately applied to foods incorrectly described by the label. The word has not the same significance as 'adulterated,' and yet the two terms may frequently be applied to the same product. For instance, commercial starch is sometimes added to sausage to increase its weight and permit of the use of a larger amount of water or of fatter meat than could otherwise be used. Such a product may properly be deemed adulterated, and at the same time, if the article were properly branded, it might not be open to objection either on the score of unwholesomeness or adulteration. If such an article, however, be sold simply as sausage, the purchaser must naturally assume that no substance has been added to increase the weight of the material without a corresponding increase of nutritive value. The addition of starch to sausage, therefore, is not in itself deleterious to health, but in the absence of a proper declaration is a fraud, because it cheapens the article which the customer supposes he is buying. In this connection, however, attention should be called to the claim of packers that 1 or 2 per cent of starch should be added to the sausage that is to be boiled, in order to prevent its shrinking when the sausage is cooked.

"The following definitions of 'adulteration' and misbranding,' as applied to foods, are taken from the food bill now pending in Congress:[1]

"'Sec. 6. That for the purposes of this act an article shall be deemed to be adulterated —

"'In the case of food:

"'First. If any substance has been mixed and packed with it so as to reduce or lower or injuriously affect its quality or strength.

"'Second. If any substance has been substituted wholly or in part for the article.

"'Third. If any valuable constituent of the article has been wholly or in part abstracted.

"'Fourth. If it be mixed, colored, powdered, coated, or stained in a manner whereby damage or inferiority is concealed.

"'Fifth. If it contain any added poisonous or other added deleterious ingredient which may render such article injurious to health: *Provided*, That when in the preparation of food products for shipment they are preserved by an external application applied in such manner that the preservative is necessarily removed mechanically, or by maceration in water, or otherwise, the provisions of this act shall be construed as applying only when said products are ready for consumption.

"'Sixth. If it consist in whole or in part of a filthy, decomposed, or putrid animal or vegetable substance, or any portion of an animal unfit for food, whether manufactured or not, or if it is a product of a diseased animal, or one that has died otherwise than by slaughter.

"'Sec. 7. That the term "misbranded," as used herein,

[1] House of Representatives, Fifty-ninth Congress. Report No. 2118, March 7, 1906.

shall apply to all drugs, or articles of food, or articles which enter into the composition of food, the package or label of which shall bear any statement regarding the ingredients or substances contained in such article, which statement shall be false or misleading in any particular, and to any food or drug product which is falsely branded as to the State, Territory, or country in which it is manufactured or produced.

"'That for the purposes of this act an article shall also be deemed to be misbranded:

"'In the case of food —

"'First. If it be an imitation of or offered for sale under the distinctive name of another article.

"'Second. If it be labeled or branded so as to deceive or mislead the purchaser, or purport to be a foreign product when not so.

"'Third. If in package form, the quantity of the contents of the package be not plainly and correctly stated in terms of weight or measure, on the outside of the package.

"'Fourth. If the package containing it or its label shall bear any statement, design, or device regarding the ingredients or the substances contained therein, which statement, design, or device shall be false or misleading in any particular: *Provided*, That an article of food which does not contain any added poisonous or deleterious ingredient shall not be deemed to be adulterated or misbranded in the following cases:

"'First. In the case of mixtures or compounds which may be now or from time to time hereafter known as articles of food, under their own distinctive names, and not an imitation or offered for sale under the distinctive name of another article, if the name be accompanied on the same label or brand with a statement of the place where said article has been manufactured or produced.

"'Second. In the case of articles labeled, branded, or tagged so as to plainly indicate that they are compounds, imitations, or blends: *Provided,* That the term "blend" as used herein shall be construed to mean a mixture of like substances, not excluding harmless coloring or flavoring ingredients: *And provided further,* That nothing in this act shall be construed as requiring or compelling proprietors or manufacturers of proprietary foods which contain no unwholesome added ingredient to disclose their trade formulas, except in so far as the provisions of this act may require to secure freedom from adulteration or misbranding.'

"CHEMICAL PRESERVATION

"During recent years the practice has sprung up of adding to many articles of food certain chemical substances which have the property of delaying or preventing fermentation and decay. These substances are commonly known as chemical preservatives. Among them are salicylic, benzoic, and boric acids, and their sodium salts (sodium salicylate, sodium benzoate, and borax), formaldehyde, ammonium fluorid, sulphurous acid, and sulphites.

"It is claimed by those who favor the use of chemical preservatives that the action of the latter is similar to that of salt, vinegar, and wood smoke, and that the use of the former is not open to greater objection than that of the latter. In fact, there are not wanting some who claim that the former are less objectionable than the latter. The literature regarding the wholesomeness of the so-called chemical preservatives is not by any means uniform in either approving or disapproving them. It is the opinion of this Bureau that they cannot be regarded as entirely wholesome even in the small amounts generally added to foods. The recent investigations conducted by this Bureau, in which twelve men were used as subjects, demonstrated that boric acid is injurious to health.[1] The experiments of the German Imperial Board of Health had the same result, and Germany has prohibited the use of this preservative altogether. It is almost universally conceded that formaldehyde and fluorids are injurious, and the weight of evidence is decidedly adverse to sulphurous acid as a preservative of meat products. The experiments of the Bureau of Chemistry indicate that neither salicylic acid nor benzoic acid is free from injurious effects.

"There are now upon the market a large number of brands of commercial preservatives, and there are firms who make a specialty of preparing such preservatives. These substances are usually composed of the chemicals mentioned above. They are frequently sold with the statement that they comply with all pure food laws, that they are entirely wholesome, and the claim is sometimes made that they are new products, and that their presence in foods cannot be detected by the chemist. These statements are all untrue. As stated above, commercial preservatives usually consist of common

[1] U. S. Dept. Agr. Bureau of Chemistry, Circular No. 15 (digest) and Bul. No. 84, Part I.

substances of well-known antiseptic action. Their use is forbidden in many States, and their detection is not a difficult matter.

"As a result of these claims many small manufacturers are led unwittingly to violate the food laws of the various States. By using commercial preservatives which they are led to believe are not objectionable they add substances to their foods which they would not knowingly employ. Such instances have repeatedly occurred, and a number of preparations of similar nature are also put up in small packages and sold by agents from house to house for the preparation of what is known as "cold process" preserves. These preparations are sold under the claims mentioned above, and many housekeepers have been led to use them who would not have employed them had they known their true character. Unfortunately, they are sometimes accompanied by directions for the preparation of fruits without any heat whatever, and in such cases the amount of preservatives employed is often far in excess of that which even the advocates of food preservatives advise.

"COLORING MATTER

"Some difference of opinion has arisen among hygienists regarding the wholesomeness of the substances frequently employed for coloring foods. European countries have legally recognized the wholesomeness of a considerable number of coal-tar derivatives. In this country a preference is frequently given by the State laws to vegetable colors, although coal-tar derivatives are more commonly employed.

"As far as their application to the preparation of foods is concerned, coal-tar colors have been found to be much more satisfactory from a technical standpoint than the pure vegetable colors. They are readily soluble, are cheap in consideration of the amount employed, and withstand the action of light and time much better than the ordinary vegetable colors available for coloring food.

"In addition to any influence on digestion and health which the coal-tar colors may have, a certain amount of arsenic is added to them by some methods of preparation. In some colors, however, prepared with a special view to use in foods, arsenic is practically or entirely absent. In this connection it must be borne in mind that the amount of coloring matter necessary to give a food the desired tint is very small, and the danger to health resulting from its use should not be exaggerated. The question of fraud, however, remains, and the use of colors enables the manufacturer to give inferior products the appearance of high-priced goods. Yet again the colors may be used merely to produce an appearance more attractive to the eye and in accordance with popular taste, even though the best materials were employed. Thus, coloring matter may be added to foods for any of the following reasons: It is sometimes placed in jelly and similar preparations when made only from the more expensive fruits and sugar, to make the color more permanent and enable the product to retain its appearance for a longer time upon the shelves of the grocer. If a considerable portion of the fruit has been replaced by means of apple juice and glucose, the coloring matter is added to simulate the appearance of the fruit that is supposed to be present. In the cheapest grade of jellies, which are made entirely from apple and glucose, and flavored artificially to imitate the product of higher priced fruit, coloring matter is employed to represent the appearance of the product imitated.

"In the preparation of tomato catsup the natural coloring matter of the tomato is largely destroyed. This destruction is not so complete if the product is promptly made as when the pulp is stored for a considerable time before it is used, long storage of the pulp bleaching it to some extent. The addition of a little coloring matter, therefore, has been resorted to for the purpose of imitating the color of the product which is made promptly and by the most careful methods. The addition of color, however, is likely to be abused, and this tendency has resulted in placing upon our market tomato catsup of a deep red color, much more vivid than could possibly be obtained without the use of artificial colors.

"In the preparation of cucumber pickles the natural green of the cucumber is somewhat impaired. Some manufacturers have employed copper compounds for the purpose of imparting to the product a greenish tint. This also has been carried to excess, and we sometimes find upon our market pickles of a bright green hue which is not suggestive of any natural food. The same practice obtains in the preparation of canned peas and beans. The great majority of those products imported from Europe are colored with copper, and as a result are of a much brighter color than the same vegetables cooked when gathered freshly from the garden.

"In the manufacture of butter it is found that the color varies with the season of the year, the feed of the cow from which the milk is obtained, and within certain limits with the breed of the cow. This results in a variation in the color of butter which manufacturers have attempted to correct by adding a sufficient amount of coloring matter to make the color uniform. This practice has also been carried to excess, and the butter now on our market is colored more deeply than is natural. This color varies in different markets of the country. Fortunately, during recent years, there has been a tendency to decrease the color of the butter, and it is to be hoped that before many years people will demand a product which is prepared without any addition of color whatever.

"Coloring matter is sometimes employed for the purpose of simulating the appearance of a more perfect article than that actually used. For instance, in the preparation of canned tomatoes a product having a certain brightness of color may be obtained if the tomatoes are perfect, fully ripe, and of certain varieties. Often, however, the tomatoes delivered to the canner do not yield a product of the desired color. For this reason some canners make a practice of adding coloring matter to their product, thus giving it an appearance which they say is more acceptable to their customers.

"Again, in the case of meat, the color disappears after considerable time, the meat losing its bright, fresh color before the process of decay is evident. Therefore, the coloring matter is not usually applied to fresh meat held at low temperature, but to chopped meat, Hamburg steak, and sausage, the addition of coloring matter to this product thus giving it the fictitious appearance of fresh meat.

"BAKING POWDERS AND BAKING CHEMICALS

"Baking powders consist of a mixture of bicarbonate of soda with some acid ingredient. When the powders are moistened, these two substances unite and liberate carbon dioxid gas. To prevent the two substances mentioned above uniting prematurely while the baking powder is still in the package, owing to moisture in the atmosphere, starch is usually employed as a filler. Some brands are claimed by the manufacturers to contain no filler, but to consist exclusively of sodium bicarbonate and the acid ingredient employed.

"CANNED VEGETABLES

"Canned vegetables constitute a class of products relatively free from adulteration by means of foreign substances. Imported canned peas are commonly colored with copper sulphate. Owing to the enforcement of the imported food law by the Bureau of Chemistry, the presence of copper is now almost universally stated on the labels of these goods. Peas and beans grown and canned in America are rarely colored.

"One of the most frequent frauds in this class of products is the preparation of goods which have reached a relatively mature state, and the selling of such products as first grade. Mature peas, for instance, are sometimes soaked for the purpose of softening them, canned, and sold as peas of first quality. Again, peas that are not thoroughly ripe, but so nearly mature as to be relatively hard and white, are sometimes canned as a high grade article.

"At the period at which sugar corn is canned the sugar disappears very rapidly after picking and it is customary to add some sugar at the time of canning. During recent years many canning establishments replaced sugar with saccharin, an artificial sweetening material derived from coal tar. A few years ago it was customary to bleach corn for canning by means of sulphites, but this practice has been almost entirely discontinued.

"Tomatoes are sometimes colored artificially in order to add to the price of an inferior article.

"CEREAL PRODUCTS

"BREAKFAST FOODS

"During the last few years the number of breakfast foods on the market has been enormously increased, and very many of them are extensively advertised by means of greatly exaggerated statements regarding their nutritive value. Some of these products are simply ground with no other preparation than the removal of the hulls, etc. Others are partially cooked, and still others are 'predigested' by means of special treatment.

"There appears to be some doubt as to the amount of advantage derived from the treatment to which the partially cooked and predigested foods are subjected. All breakfast foods when thoroughly cooked seem to be equally as digestible as the products placed on the market in a more advanced state of preparation.

"The rumors which have been circulated from time to time that arsenic and other poisonous substances are used in breakfast foods have been entirely without foundation. There is no doubt of the wholesomeness of these foods. At the same time, the exaggerated claims made by the manufacturers regarding their superior nutritive qualities are to be deplored.

"FLOUR

"There is an impression in some quarters, unfortunately, that flour is adulterated with ground gypsum or other mineral matter. It is also believed by many that alum is used for the purpose of whitening bread. It may be said, however, that these forms of adulteration are not practiced in this country.

"Some years ago an effort was made to place on the market a ground stone for the purpose of adulterating flour. This product was extensively advertised by means of circular letters addressed to millers. As far as we have been able to ascertain, however, the product was never used. At one time during recent years the use of Indian corn flour for the adulteration of wheat flour became somewhat prevalent. This practice was entirely stopped by the enforcement of the Federal law relating to mixed flour. At the present time there is probably no product on our market more free from adulteration than wheat flour.

"Some adulteration is practiced in special kinds of flour. For instance, much of the so-called gluten flour on the market is not at all what it purports to be. Frequently untreated wheat flour is sold for gluten flour. Buckwheat flour and other special articles of that nature are also frequently adulterated with cheaper cereal products.

"COCOA AND CHOCOLATE

"In the preparation of cocoa and chocolate, cocoa beans are roasted, freed from shells, and ground. The resulting product is known as cocoa mass. It contains about 50 per cent of fat (cocoa butter), and is sometimes melted into cakes without any further addition and sold as plain chocolate or bitter chocolate.

"For the preparation of sweetened chocolate, cane sugar is added to the cocoa mass and ground at a temperature sufficient to melt the fat. Milk chocolate is prepared by mixing with the cocoa mass dry milk powder (obtained by the evaporation of whole milk) and sugar.

"Cocoa is obtained by pressing the cocoa mass while still sufficiently warm to melt the fat so that a portion of it is removed. The fat is melted into cakes and sold as cocoa butter, while the pressed cakes of cocoa from which a portion of the fat has been extracted are ground up in the preparation of breakfast cocoa.

"For the purpose of cheapening cocoa and chocolate, starches of various kinds are ground in with the cocoa mass at the time of the introduction of the sugar or with the cocoa after the expression of the fat.

"COFFEE AND TEA

"Owing to the enforcement of the Federal tea law, by inspectors stationed at all ports of entry, it is believed that no adulterated tea comes into this country, and it is probably true that the adulteration of this product is not practiced after entry. Formerly it was believed that many other leaves were used as substitutes or adulterants for tea, and a sample may be readily examined for such adulterants by thoroughly wetting and unrolling the leaves and noting their shape.

"With regard to coffee, however, while it is believed that only the pure product is brought into the country its adulteration after reaching our shores is not uncommon. The attempts that have been made to imitate the coffee bean have not been commercially successful, but the ground coffees sold in the market are frequently adulterated. For this purpose chicory was usually employed, but has since been largely replaced by articles of lower value — ground peas, wheat, beans, barley, etc., now being commonly used. The principal offense in the coffee trade is misbranding as to country of origin. The sale of Brazilian coffee, for example, as Java or Mocha is unfortunately very common.

"The artificially molded coffee berries, referred to above, are not on the market, as far as is known, but may be readily distinguished by cutting a cross section of the bean and examining its structure. That of the artificial bean is of a compact, solid, uniform nature, whereas the true coffee has a characteristic structure that cannot be imitated. If pure coffee is desired, therefore, the most practical plan is to buy it unground.

"DAIRY PRODUCTS

"BUTTER

"The sale of oleomargarin as butter was formerly very common, but the enforcement of the internal-revenue laws, relative to that subject, by the Treasury Department, and of the State laws,[1] have greatly lessened this species of fraud, although violations of these laws still occur with considerable frequency.

[1] U. S. Dept. of Agr., Bureau of Chemistry, Bul. 69 Revised, Parts I–VIII, Foods and Food Control.

"It is now the custom to treat much of the rancid butter on the market in such a way as to remove the rancidity in the preparation of what is known as 'process' or 'renovated butter.' In the early days of the manufacture of this article it was ordinarily sold as fresh butter. At the present time, however, this product is required to be marked on the wrapper with the words 'Renovated Butter,' and violations of the law requiring this are relatively infrequent. This law is enforced by the Bureau of Animal Industry of the Department of Agriculture in collaboration with the Treasury Department.[1] The chemical analyses necessary in the enforcement of the law are made in the Bureau of Chemistry.

"Butter is sometimes preserved with boric acid, and glucose has sometimes been found as an adulterant. The coloring of butter is usual, and is permitted by the laws of all the States. The principles governing the legislation regarding coloring matter of foods in general have not been ordinarily applied to the coloring of butter. The present tendency, however, seems to be to prepare butter with a lighter tint, and a more natural-looking article can now be found in the market than formerly.

"CHEESE

"One of the most frequent methods of adulterating cheese is to prepare it from milk which has been skimmed and to which some other form of fat has been added for the purpose of replacing the fat of the cream removed. Both lard and cotton seed oil have been used for this purpose. Cheese which has such an addition of foreign

[1] U. S. Dept. of Agr., Bureau of Chemistry, Bul. 69 Revised, Part I, p. 28.

fat is known as 'filled cheese.' Such a product well illustrates a form of adulteration which, although it may not be at all unwholesome, is fraudulent, and if sold as full cream cheese constitutes a form of misbranding. Such a sale is unfair to the buyer, aside from the question of price. If the cheese is desired for melting, as in making a Welsh rarebit, or for other use in cooking, the foreign fat or oil of the filled cheese will separate much more readily than from a genuine cheese, leaving a gummy mass, instead of melting smoothly as a full cream cheese will do.

"CREAM

"Cream is frequently preserved artificially. This is illegal in most of the States, but some which prohibit artificial preservatives in milk permit them in cream. How this position is justified does not appear. During recent years preparations known as 'thickeners' have been sold to permit dealers to sophisticate their wares. These thickeners ordinarily consist of gelatin, and sometimes contain boric acid for the purpose of preserving the cream.

"Since in the use of cream the dietetic value of fat is taken into consideration, and especially since it is frequently employed in the preparation of modified milk for the use of infants, the sale of a product in which the fat has been largely replaced by gelatin should be condemned in strong terms.

"MILK

"The most serious problem connected with food control is the regulation of the milk supply. A considerable portion of the milk consumed is employed as food for infants and invalids. In such cases it frequently forms the entire food consumed by an individual. For that reason, and because of the susceptibility of infants and invalids to interfering substances, it is imperative that the quality of the milk supply be carefully guarded.

"The addition of preservatives to milk is particularly to be condemned, partly because of the influences of the preservative itself on the health of infants and invalids by whom the milk may be used as a food, and partly because of the less cleanly methods that may be employed in the preservation of milk when preservatives are used, and of the increased danger in the consumption of such milk.

"The most common adulteration practiced with milk is the addition of water or the removal of cream. The management of the dairy and the care of the milk from the time it is received from the cow until it is delivered to the consumer are attended by great difficulties. If the milk is to be kept without chemical preservation, absolute cleanliness and prompt, intelligent care are imperative. This is true at all times and especially in the summer. The milk must be cooled immediately and kept cool until its delivery to the consumer, and then delivery must not be delayed too long. Even after the milk is left at the door of the consumer considerable annoyance is caused by many who do not take their milk promptly and place it in the refrigerator. It is frequently allowed to stand at the door for a considerable time, and then many cases of spoiling for which the consumer is responsible are attributed by him to the dairymen.

"In order to avoid these inconveniences the use of preservatives with milk is frequently practiced wherever the enforcement of the food laws is not rigid. In this connection especially the use of commercial preservatives represented to be in conformity with the food laws is of interest.

"FRUIT PRODUCTS

"The class of foods known as fruit products includes jams, jellies, marmalades, and dried and preserved fruits of every description. Glucose is often used as a substitute for cane sugar and coloring matter is employed in order that the color of the finished article may stand for a considerable time on the shelves in the light without deterioration. Coloring matter is also used with cheap fruits in the preparation of a product supposedly made from more expensive products. For instance, jellies are sometimes made of glucose and apple juice, the latter having been prepared from peelings and cores, the by-product of the manufacture of dried apples. These jellies may be flavored and colored to represent the jelly of high-priced fruits, or they may be sold without additional flavor and as a low-priced product. Always, however, when the product of a high-priced fruit is imitated artificial coloring matter is employed.

"Apple juice, as mentioned above, and especially the product obtained from peelings and cores, is used extensively with the cheaper grades of jellies where but little fruit is used. With the cheapest grade of goods, starch is often used as a filler and gelatinizing agent.

"Preservatives, such as salicylic acid and benzoic acid, are often employed with jellies and jams. Their purpose is twofold: First, to preserve apple juice in barrels until it is desired in the manufacture of the finished product; second, to prevent molding in the finished article which is subjected to much less favorable conditions during transportation on trains and in heated storerooms than is the case of the domestic product, which stands quietly, often in a cool, dark cellar, from the time it is made until it is used.

"The exhausted residue from the manufacture of jelly is sometimes used for the preparation of jams, giving to the latter the seeds and other insoluble material of the fruit supposed to be present, while the soluble material is frequently made up of glucose. Occasionally foreign seeds are used for this purpose. Glucose, as has been already stated, is commonly used in the cheaper varieties of fruit products, and sometimes, though very rarely, saccharin is employed for sweetening.

"MEAT PREPARATIONS

"In this class of foods are considered fresh and prepared meat, fish, crabs, oysters, and similar products. The fresh meats on the market are rarely subject to adulteration. Packers depend entirely on cold storage for their preservation, and they are kept at a low temperature, not only in the packing house, but also in refrigerator cars in transit and in cold-storage rooms at their destination until immediately before they go into consumption.

"In fresh meats, however, preservatives are sometimes employed by retail dealers who have not efficient refrigerator service or who desire to keep fresh meat for a considerable time on the block. For this purpose powdered preparations of preservatives are employed, and dusted over the meat from time to time.

"All varieties of meat that are sold in a finely comminuted state, such as chopped meat, Hamburg steak, and sausage, are likely to have a preservative added in their preparation. By this statement it is not meant that preservatives are added in all cases. Their use, however, simplifies the keeping of such preparations and is not unusual. The preservatives most commonly employed with meat are borax or boric acid and sulphites. Oysters, when kept in bulk after shucking, are also frequently preserved.

"It is frequently pointed out by manufacturers that the addition of preservatives does not restore the fresh character of spoiled meat and that they cannot be used for this purpose. As has been stated above, however, sometimes meat, especially in a finely comminuted condition, frequently loses its natural fresh color before there is any other evidence of deterioration. This color is restored to a certain extent by the addition of sulphites, and the color is very materially preserved if sulphites are added at the time of the preparation of chopped meat. Moreover, manufacturers of chemical preservatives frequently add a small amount of coal-tar color to preservatives consisting of sulphites intended to be added to meat.

"One of the most objectionable forms of adulteration practiced in connection with meat is the sale of the flesh of immature calves. This practice is forbidden in practically all of the States, but the enforcement of such laws has sometimes been found very difficult. Particular difficulty has been experienced in this matter in New York."

This bulletin also contains tables of the adulterants formerly used in olive oil, lard, flavoring extracts, spices of all kinds, sugars, sirups, vinegars, and condimental sauces, together with simple methods for their detection.

CHAPTER III

AIR, CLIMATE, VENTILATION, HEATING, LIGHTING

SECTION I

Nature and Composition of the Atmosphere. — Air consists of a mechanical mixture of gases of remarkable uniformity, which envelops the earth to a depth which is estimated to be about forty miles, and which penetrates the soil and the ocean.

The weight pressure of the atmosphere, which is estimated by means of the barometer, is equivalent to about fourteen tons to the surface of an adult human body.

The pressure of the air decreases as we rise above the sea level, and increases as we descend below its level; and any considerable or sudden variation in this pressure may produce disturbances of health, such as the heart derangements common to persons first visiting high altitudes, known as "mountain or balloon sickness," and the "caisson disease" of tunnel workers or others laboring in compressed air.

A sudden increase or decrease of atmospheric pressure is especially injurious to all persons suffering from heart or lung diseases.

By an arrangement of air locks, workmen coming out of a caisson may do so safely by a wait of six or eight minutes at each lock. Too rapid change of pressure with great physical exertion may produce spinal hemorrhage.

Composition of Air. — Air is a transparent, colorless, and odorless mixture of oxygen, nitrogen, argon, carbonic acid (carbon dioxide), and traces of other substances. Ordinarily air is not odorless, but contains scents arising from many sources to which we become accustomed and do not detect them.

The average normal composition of air is about as follows: oxygen, 21 per cent; nitrogen and argon, 78.7 per cent; carbon dioxide (carbonic acid), 0.03 per cent; aqueous vapor varying with the temperature and other conditions; a trace of ammonia; and a variable amount of ozone, organic and other matters.

The mixture of the air is mechanical, not chemical, as was formerly supposed, its wonderful uniformity being maintained by the relative processes of animal and vegetable life, and by the law governing the diffusion of gases, which is that "a gas expands into a space in which there is another gas, as freely and as rapidly as if there were a vacuum."

Oxygen is the element in the air which supports life. The normal amount of oxygen in the atmosphere may vary slightly, as at sea or near vegetation by day it may be slightly increased, or at a great altitude it may be a very little less; but at sea level any decrease in amount would be readily overcome by the law of diffusion.

Oxygen is constantly being taken up from the air by respiration, and returned to it in combination with carbon, known as carbon dioxide, which is in turn taken up by vegetation, the carbon being retained and the oxygen returned to the air, thus maintaining the uniformity of the atmosphere.

For sustaining animal life the air must contain not far from a normal amount of oxygen. Human life is impossible with less than four fifths of the normal proportion, and equally so when greatly increased. The decrease of oxygen to less than 13 per cent causes respiration to become slower and more difficult, and asphyxia and death soon follow. Fatal asphyxia occurs very speedily when the volume of oxygen has decreased to 3 per cent.

It is stated that the lungs of an adult man absorb about one fourth of the oxygen inhaled, and that he inhales in 24 hours 34 pounds of air, containing something over 7 pounds of oxygen, which would mean that slightly less than 2 pounds of oxygen is absorbed daily.

Oxygen is also essential to the growth of vegetation, for while plants take up carbon dioxide and exhale oxygen, they also breathe as do animals by absorbing oxygen and exhaling carbon dioxide.

Nitrogen, the principal constituent of the atmosphere, serves to dilute the oxygen, rendering it respirable, but nitrogen takes no further part in animal respiration. Nitrogen is absorbed by certain plants (legumes) directly from the air and stored for animal use in the form of proteids, the original source of nitrogenous foods.

Argon is a recently (1894) discovered element of air, its quantity and purpose still being uncertain.

Ozone is a normal but inconstant element of air of unknown origin, which is almost never found in large cities, towns, or inhabited dwellings, but has been found in minute quantities (1:700,000) in the open country, or at sea.

Hydrogen, krypton, neon, and several other elements have been discovered in traces as constituents of air.

Carbon dioxide is found in all air, the normal average in pure air being 3 parts in 10,000 or 0.03 per cent. Carbon dioxide results from the oxidation of organic matter, from respiration, fermentation, combustion, and chemical action of the soil, and within the limit of 3 parts to 10,000 may not be considered an impurity of the atmosphere.

The respiration of millions of human beings and animals, the combustion of coal, wood, gas, and all other fuel, and the huge volumes sent forth by the air from the soil, throw tons of carbon dioxide into the atmosphere, which is purified of its excess by the absorption of it by vegetation and great bodies of water; the latter it is said will take up its own volume of the gas.

It is generally held that a large amount of carbon dioxide may be present in the air without producing any injurious effects, *provided* there is an abundance of oxygen; that the ill effects of impure air arise from the organic matter thrown off with the carbon dioxide from the skin and lungs.

A crowded assembly room may contain as high as 100 parts of carbon dioxide to 10,000.

The *aqueous vapor* in the atmosphere varies with the temperature, evaporation and condensation going on continuously. The higher the temperature the more rapidly evaporation takes place. The proportion of humidity most agreeable and healthy for human beings is about 75 per cent of saturation at any given temperature.

The sources of aqueous vapor in the air are from bodies of water, moisture from the soil, from the skin and lungs of men and animals, from foliage, and from combustion.

Ammonia and organic matter exceeding a trace, in outdoor air may be regarded as impurities, such contamination usually arising from putrefaction or from certain manufacturing industries.

Dust is considered a normal constituent of the atmosphere as it is always present, arising from innumerable sources.

Dust may be organic or inorganic (mineral) and is lifted by the movements of the air, the organic matter being partially oxidized, and the solid particles falling to the earth.

Organic dust does not exist in high altitudes.

Micro-organisms are numerous in the atmosphere of cities, towns, and inhabited dwellings. The number of bacteria in the air is influenced by the action of the winds and the amount of humidity; they are carried some distance by the winds, are washed out of the air by rain or snow, and may be killed by exposure to sunlight.

It is a question still in doubt, whether disease germs (pathogenic organisms) are ever found in the air without being adherent to particles of dust. In considering the presence of bacteria in the air it should always be borne in mind that by far the greater proportion are harmless.

Soil air is different from the air above ground, as it contains large quantities of the products of putrefaction which goes on continually in the soil, and also a larger proportion of carbon dioxide and other injurious gases, the principal one being known as marsh gas.

In caves and wells, the air may have undergone such contamination from putrefaction and chemical changes in the earth as to become highly inflammable and unfit for respiration.

Soil air penetrates dwellings because the air of the buildings being warmer than the surrounding soil and the warm air having an upward tendency, the air is drawn (aspirated) from the soil into the dwellings; hence newly made soil, particularly in cities, may be considered unhealthy.

Sewer air in properly constructed sewers which have free ventilation, is not now considered as dangerous as formerly, as it has been found that the air of such sewers differs slightly from the outside air, usually showing a little increase of carbon dioxide and less of micro-organisms. The danger from sewer air arises from any obstruction of the sewer shutting off the ventilation, and causing an accumulation of gases arising from putrefaction.

Carbon monoxide is a poisonous gas arising from imperfect combustion of illuminating gas, from leaking gas pipes, or from defective coal furnaces or stoves.

Gas leaking from the mains in the streets into the soil is often drawn into dwellings by the difference in the temperature inside and outside as cited in the case of soil air. Fatal cases of gas poisoning in dwellings are recorded, where the gas has been drawn through the soil for more than a hundred feet under a well-constructed pavement.

The odor of gas does not always serve as a warning, as the soil through which it passes sometimes retains the odor.

Carbon monoxide produces unconsciousness, heart-failure, and at high temperature, convulsions; in small quantities headache and dizziness are followed by insensibility.

Sources of Impurities in the Atmosphere. — The sources of the impurities of the atmosphere may be divided into two classes, gaseous and solid.

Of the gaseous, carbon monoxide and dioxide, marsh gas, hydrogen sulphide, and gaseous organic substances such as ammonia are the most important.

Dust, organic and inorganic, the débris of animal and vegetable organisms, and living micro-organisms constitute the solid form of atmospheric impurities. Among these impurities are included the organic matters from the body such as epithelium, sweat, the volatile matters from decaying teeth and the digestive tract, and excreta deposited upon unclean clothing.

The impurities due to respiration are the decrease of oxygen, the increase of carbon dioxide, the increase of watery vapor to saturation, and the addition of organic matter. It is said while a large amount of carbon dioxide may escape with very imperfect ventilation, the aqueous vapor and organic matter cling to the surfaces of the room and its contents; the proof of which is the fact that after a prolonged airing an odor of organic matter still remains in such a room.

It is generally conceded that impure air is the most important exciting cause of disease, and that a normal proportion of oxygen in the air is necessary for health, this theory being proven by the well-known fact that among out-of-door workers the death-rate is very much lower than among those employed indoors. Pulmonary tuberculosis (phthisis) is especially associated with overcrowding, and the high death-rate of jails and barracks, formerly so common, was no doubt due to crowded quarters.

Effects of Bad Air. — The immediate effects of inhaling impure air are discomfort followed by headache, dizziness, and nausea, and if continued, as before stated, with less than 13 per cent oxygen the respiration becomes slow and difficult, perspiration is profuse, and asphyxia and death soon result.

The continued breathing of bad air in lesser quantity causes a gradual loss of health manifested by pallor, languor, anæmia, loss of appetite, and loss of resistance to diseases, the last being one of the most injurious effects.

The air of workshops and factories contains not only the impurities arising from the respiration and perspiration of workmen, but to combustion from heating and lighting; and to these may be often added overheating and overcrowding, besides lack of personal cleanliness.

Certain occupations expose workmen to impure air from special sources, such as miners, bakers, workers in silk and cotton mills, in bleaching works, in the manufacture of zinc, steel, brass, wall paper, artificial flowers, cutlery, guns, cabinet-making, etc.

In factories where hides and feathers are used the dust is of animal origin.

Much attention has been given during recent years to providing sufficient air space and ventilation for workshops and factories, besides apparatus for mechanically removing the dust or fumes arising from the various industries; many states having passed stringent laws for thus protecting workers.

The impurities of the air in dwellings arise from respiration, perspiration, combustion, faulty sewerage, and very largely from bad housekeeping, which permits uncleanliness of the dwelling and its occupants. With fairly good ventilation the air of a dwelling cannot be pure if it be filled with dusty carpets, curtains, and walls; if both bed and body clothing be soiled, if cellars, pantries, and ice boxes are filled with decaying food and unclean utensils, if bath rooms and kitchen sinks are dirty and drain pipes filled with an accumulation of grease and other filth. It is not too much to say that most dwellings would have better air if there were less furniture and decoration, and more attention paid to everyday cleanliness.

In hospitals the sources of impurities in the air are the same as in dwellings, multiplied by many degrees and to which may be added the manifold germs of disease and exhalations from the bodies of sick persons, thus requiring especial care in guarding against overcrowding and overheating, and in providing perfect cleanliness in every detail of housekeeping and nursing.

In schools and other assembly rooms the impurities of the air are mainly due to overheating and overcrowding, together with the effects of respiration, perspiration, and combustion.

The impure air of large office buildings, courthouses, railway stations, day and sleeping cars is aggravated by the almost universal fault of overheating, which, taken together with the impurities of respiration, combustion, uncleanliness, and faulty ventilation, produce an enormous volume of foul air.

Section II

CLIMATE, VENTILATION

The climate of a locality depends mainly upon its distance from the equator, its height above sea level, its nearness to large bodies of water, and to its prevailing winds.

Given the same distance from the equator and the sea, a mountain locality will have a cooler climate than a lower level.

The middle of a continent is subject to extremes of heat and cold unknown on the seacoast, while the latter is much more humid.

The prevailing winds are governed by the presence or absence of mountain ranges.

Climate is usually designated as temperate, polar, or tropical.

Climate and Health. — In tropical climates disorders of the liver, digestion, and nervous system are common, while in the polar climate the digestion is good, the nervous system sluggish, muscular development greater than in the tropics, but lung and kidney diseases are prevalent.

The temperate climate is therefore the healthiest as there is less continued strain upon the organs of the body than in the extremes of heat and cold of the tropics and polar regions.

The effects of a tropical climate upon persons coming from a temperate zone, are bleaching of the skin, sometimes due to anæmia but generally ascribed to the profuse perspiration, sluggishness, and relaxation, loss of appetite, impaired digestion due principally to drinking too freely to supply the loss of fluids by perspiration, and the common excessive use of alcohol. It is said that the tropical climate acts especially unfavorably upon the female organism.

The infectious diseases, yellow fever, cholera, plague, dysentery, and malaria, prevail in tropical climates. The influence of climate upon certain diseases is well known; that of such regions as the Rocky Mountains, southern California, and the mountains of North Carolina, which are particularly dry, being beneficial to tuberculosis, while the damp cool climate of England and the region of the Great Lakes of the United States is no doubt the cause of the lung and kidney diseases which prevail with alarming frequency during the winter months.

Season exerts a marked influence upon mortality, deaths from diseases of the respiratory system occur more frequently in winter and those from intestinal diseases during the summer, notably typhoid fever and the infantile diarrhœas.

VENTILATION

By the term "ventilation," we understand a process by which a constant supply of pure air is introduced into buildings or rooms, with a simultaneous discharge of impure air. But it is well for us to understand that at the best it is impossible to provide as pure air indoors as outdoors, it being held that any system of ventilation which limits the amount of carbon dioxide to 6 or 7 parts in 10,000 may be called good; and also that no system of ventilation, no matter how perfect, can do much more than remove the impurities due to respiration and combustion; the solid and organic matter due to filth can only be removed by the practice of cleanliness both inside and outside the building.

Given cleanliness of a building and its contents, the need for ventilation is somewhat limited, a point of much importance in a climate like that of the northern part of the United States where artificial heating is required for more than half of the year.

The amount of air required is from 30 to 50 cubic feet per minute for each person to maintain a fair degree of health; less than 30 will produce impaired vitality. At such a rate a person in a confined space would require 3000 cubic feet of air hourly properly to dilute the impure air from his own respirations.

The supply of fresh air must be constant to prevent an accumulation of impurities which would occur were the air replaced only by an occasional renewal.

The minimum cubic space required for each person at the rate of providing 3000 cubic feet of air hourly would be 500 cubic feet, allowing one fourth more in hospitals and sick rooms. But this would require that the air be changed six times hourly — a process almost entirely impracticable in our winter climate.

Changing the air three times hourly with an allowance of 1000 cubic feet to each person may be carried out under favorable circumstances, but in winter this is impossible in the majority of dwellings.

The space allowed for each person may be less for large assembly halls than for living rooms, as it is much easier to change the air without perceptible draughts in large rooms than small, and also for the reason that an assembly hall is occupied for only a comparatively short time.

To ventilate without draughts in small rooms presents many difficulties, as diffusion takes place much less rapidly than in larger spaces and the inlets and outlets are necessarily very near together.

Natural Ventilation. — The natural forces which are constantly at work at all times and to a great extent control ventilation whether buildings are provided with special apparatus or not, are diffusion, and the difference in the density of air at different temperatures.

The diffusion of carbon dioxide and other gaseous impurities from a room into the outer air takes place not only through the windows, doors, and crevices, but through the walls and ceilings, the amount of diffusion depending upon the porosity of building material, the difference between the outdoor and indoor temperature, and the direction and force of the wind.

Dampness in the walls prevents diffusion, which is one reason for the unhealthfulness of damp dwellings.

The action of the wind works in two ways: by perflation (blowing through) and aspiration (drawing out), as the wind blowing across a chimney or ventilating flue creates an upward current. Thus a fireplace affords a means of ventilation. The movement of air is caused by the difference in the weight of masses of air of different temperatures, the warmer air being lighter expands and rises, being displaced by heavier and colder air; the greater the difference in temperature of these masses the more rapid the movement.

The chief force in natural ventilation therefore is movement of the air.

F

The more tightly fitting windows and doors are made, and the more impervious the walls are built, the more obstruction is offered to natural ventilation, but inlets and outlets properly placed afford assistance to natural ventilation which may be supplemented by the temporary opening of doors or windows.

Inlets and outlets for ventilation should be placed according to the size, position, and method of heating the building or room, as no hard and fast rules are possible which would cover all conditions; the intake for pure air entering the building should, however, always be raised some distance above ground to avoid street dust. By a series of experiments the following general conclusions may be drawn; that the best results obtain

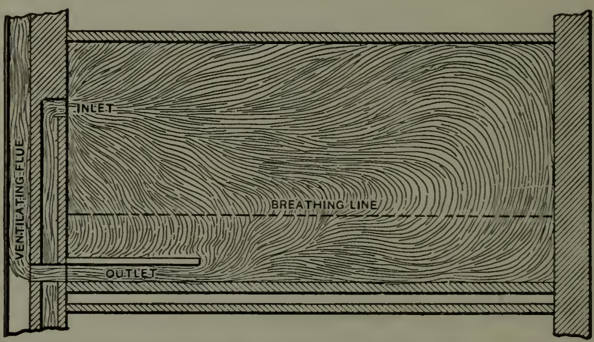


Fig. 1. — Proper inlet and outlet for ventilation. (Carpenter.)

when the inlet for a room is on the side of a room near the top, and the outlet is in the bottom near the center. In order to prevent draughts the movements of the inlet air must be slow, agreeable in temperature, and its humidity neither too high nor too low. The current of air may be broken by subdividing the openings of both inlets and outlets and especially the inlet opening.

Unless they are heated artificially the inlet flues should not be placed in the outside walls, as the cooling of the column of air may produce down draughts. The air flues or shafts should be circular in shape with smooth inside surfaces and with as few angles as possible which interfere with air currents.

It should be borne in mind that unless air shafts are properly placed the air currents, following the natural laws which govern them, may be reversed, and ventilation be entirely defeated.

Partial ventilation may be secured sometimes by placing a board 4 or 6 inches wide fitted under the lower window sash, which prevents a draught by directing the current of air upward between the two sashes.

A screen frame covered with cheesecloth or lightweight flannel, fitted at either the top or bottom of the window, provides a partial ventilation without draught and excludes soot and dust.

There are many patented devices for window ventilation, such as sliding or revolving panes, — some satisfactory and others useless.

Mechanical Ventilation. — In large buildings, such as hospitals, theaters, and schools, mechanical ventilation becomes a necessity, the especial advantage being that thorough ventilation may always be accomplished in any and all variations of weather.

Two systems of mechanical ventilation are used: propulsion or "plenum" system, and abstraction or "vacuum" system.

In the *plenum system* the air is drawn into a box by the revolving blades of a fan, and propelled through a central shaft with the necessary branches leading to various parts of the building; when desired, the air may be first received into a chamber and heated. The air supply is regulated by the number of revolutions of the fan.

The abstraction or vacuum system abstracts the air from through pipes leading to a central shaft, where it is drawn in by a fan and discharged outward. This system is said to be less satisfactory in that, by the vacuum created, cold air is drawn in through all crevices, causing draughts and cold floors to prevail; likewise more fuel is required.

A combination of both plenum and vacuum systems has been found most satisfactory.[1]

The filtration of air for certain buildings is carried on to some extent,—the filtration being either through water or cloth.

"In the building of the American Bell Telephone Co. in Boston the air is drawn into and through a system of large cotton bags 30 feet in length, in which all dirt and dust is retained. About a peck per month is separated in this way from the air, which is drawn, not from the street level, but far above it. An analysis, chemical and microscopical, made in April, 1897, showed 22.67 per cent organic and 77.33 of inorganic matter; the material consisted of all manner of animal, mineral, and vegetable substances ordinarily present in the dust of cities."[2]

[1] Supplementary Lesson. *Primary Nursing Technique,* McIsaac, p. 11.

[2] *Practical Hygiene,* Harrington.

Section III

HEATING, LIGHTING

The heating and ventilation of buildings are so interdependent that they must necessarily be considered in connection.

Fresh air in abundance is required for the process of combustion, to replace the impure air arising from the consumption of oxygen by combustion, and to replace the heated air which escapes.

Required Temperature. — An average temperature of 70° F. for living rooms and 65° F. for bedrooms is considered the healthiest degree of warmth for vigorous adults, with a slightly higher temperature for children and the aged; but the warmth required by different individuals in good health varies to a wide degree and inflexible rules are impossible to follow. That overheating is a serious fault in the majority of buildings is evident, and it is further noticeable that men endure or require a much higher degree of heat than women.

Systems of Heating. — There are three systems of heating in common use: direct radiation, indirect radiation, and direct-indirect radiation.

Direct radiation is from a fireplace, or from a stove or steam coil in the room. Heat from a stove or steam coil is less radiant than from a fireplace, as the air is heated and brought into circulation in the room, known as heating by convection.

Indirect radiation is accomplished by heated air being carried by flues from a central heating point to various rooms of a building, such as a hot-air furnace.

Direct-indirect radiation is where the heating surfaces are in the rooms, with the addition of an arrangement for admitting outside air which may be cut off, making *direct radiation.*

Fireplaces heat almost entirely by radiation, and while removing the impurities of combustion to a large degree they heat only one side of a body; there being little convection, they produce draughts, a large amount of heat is lost through the chimney, and they are liable to smoke with certain winds; but as a part of other heating systems or to be used in moderate weather, and as a promoter of cheerfulness, particularly in a sick room, the fireplace has a distinct value.

Stoves are an economical mode of heating, but the dust and extreme dryness of the air are very objectionable, besides the great amount of labor which must be expended in caring for them.

Hot-water and steam heating systems each require an especial piping for conveying the hot water or steam to the various parts of the building.

It is said that the installation of the hot-water system is more expensive than for steam, but the expense of running is less. Hot-water heating is more suitable for small buildings, such as dwellings, and steam heat for the large buildings, such as hospitals, large apartment or office buildings, courthouses, etc.

Steam heating in moderate-sized buildings is usually by direct radiation, the radiators being placed in each room; but in the large buildings indirect radiation is employed by placing the radiators in a box in the ventilating flue, preferably near the top, which may be regulated by dampers sometimes controlled by thermostats.

Again, in many more modern buildings of great size, the radiators are arranged in stacks and the hot air propelled by fans through the flues to every part of the building, which enables fresh air at a certain temperature to be supplied, being considered the best method of heating large areas which has yet been devised.

The hot-air furnace is not suitable for the larger buildings, but for an ordinary dwelling is an economical and satisfactory means of heating.

The dryness of the air is an objection to the hot-air furnace which is not difficult to overcome. The fact that ventilation is obstructed when the heat is cut off is the principal objection to the hot-air furnace, otherwise the ventilation should be very good if the inlet opens to the outside air some distance above the ground level. The practice of having the inlet for fresh air open directly into the basement is obviously dangerous, particularly in cities, where the basement floors and walls are not impervious and may admit large quantities of soil air mixed with escaped gas from leaking pipes.

The position of flues and registers from hot-air furnaces should be decided by the prevailing winds, it being said that hot air will move less than ten feet against a cold wind, and will easily carry fifty feet with the wind.

Electrical heating systems have not yet been perfected sufficiently to put them within the means of people of moderate incomes, although electricity is used in a small way for heating small quantities of water, cooking single articles as with a chafing-dish, for ironing, and for supplying heat for the various hot applications used in hospitals.

Electric fans are employed for assisting ventilation.

Gas heating is employed in certain localities supplied with natural gas, which is used instead of coal in hot-air furnaces and in both hot-water and steam heating systems, giving a very cleanly easy method, as there is no dust nor ashes to remove; but especial attention must be given to ventilation and the adjustment of all gas pipes and burners, to prevent the leakage of gas.

Portable gas stoves and oil stoves are in common use for heating small rooms, and possess the great advantage of carrying easily to the place where needed. The great objection to both is in the consumption of oxygen and the throwing off of a corresponding amount of carbon dioxide, together with the unpleasant odors. Gas stoves may be easily supplied with an outlet pipe carried into the fireplace or window, and oil stoves, by being kept well filled and perfectly clean, may have the odor reduced to a minimum, but in both instances ventilation should receive especial attention.

A small tin oven set upon the top of a gas stove or oil stove will serve for a radiator, and hasten the heating of a room.

The lack of moisture in all heated buildings may be easily remedied in the household by intelligent supervision, but can seldom be trusted to the care of servants; shallow basins of water put upon the back of stoves or radiators where heating by direct radiation is employed is all that is necessary, but the basins must be kept constantly filled.

The newer steam heating systems for large buildings are usually supplied with a spray of water over the stacks of radiators, which supplies the necessary moisture.

It has been found that in buildings thus equipped the occupants are much freer from coughs and colds than where the air is exclusively dry, and also that a lesser degree of heat is perfectly comfortable, which makes a considerable item of economy in fuel.

LIGHTING

Buildings are lighted by the natural method of daylight admitted through windows or artificially by means of burning gas, oil, or candles, or by electricity.

The proper natural lighting of all buildings is one of great importance to health, the direct rays of the sun being one of the greatest factors in promoting vigor of mind and body.

Persons working by artificial light during the day, soon become pale and languid, gradually losing mental and physical vigor.

The influence of light upon health has been the subject of extensive scientific research during recent years, leading to much improvement in the natural lighting of new buildings and to the treatment of certain diseases by certain rays of light. The women of the household and hospital should supplement the improved building arrangements by removing all elaborate window draperies, especially in cities where every ray of light and breath of air is needed and should not be restricted.

Electricity is by far the best method of artificial lighting, as the combustion of gas, oil, or candles adds impurities to the atmosphere, and except in the case of the Welsbach burners, gives a feebler light. Another serious objection to oil lamps besides the great labor needed to care for them, is in their almost universal improper position in relation to the eyes. The old-fashioned hanging and bracket lamps which put the light in the upper part of the room where it belongs are almost never seen. Standing table lamps without shades should never be permitted, particularly where there are children.

CHAPTER IV

SOIL, WATER

THAT health is dependent to a greater or less degree upon the soil has been a long recognized fact. That from the soil we derive our drinking water and that nearly all garbage is returned to the soil compels men to seriously consider the relations of the public health to the soil upon which we live.

Soil is a mixture of sand, clay, and other mineral substances to which are added humus or organic matter and living organisms.

The soil is porous and contains varying amounts of air and water, the health of a community depending greatly upon the amount and purity of the soil air and soil water.

The purity of the soil air and water depends upon the amount of organic matter contained in the soil, hence the danger to health from filth deposited upon the soil.

Soil Air. — The composition and entrance of soil air into dwellings have been mentioned in the foregoing chapter on air (see p. 57).

Soil or ground water is rain water which has penetrated the soil and which contains some of the dissolved mineral constituents of the soil, as well as decaying organic matter and bacteria derived from the soil.

Damp soil predisposes to diseases of the lungs, rheumatism, and malaria, although in all cases the relation is indirect.

Pathogenic Bacteria in the Soil. — Some pathogenic bacteria, such as the bacilli of anthrax, tetanus, malignant œdema, typhus fever, tuberculosis, cholera, and typhoid fever, are capable of living, and some of them, notably tetanus, of multiplying in the soil.

The position or configuration of the soil as well as the constituents has much to do with health. The high lands being better drained and consequently drier are more healthful than low lying lands. In the low lands health depends upon the constituents of the soil itself. It is only by the most systematic drainage and disposal of garbage that the modern city escapes the devastations of the plagues which prevailed in ancient times.

WATER

Composition of Water. — Pure water, which is never found outside of the laboratory, is colorless, odorless, and tasteless, of neutral reaction, and composed of 11.11 parts hydrogen and 88.89 parts oxygen, the chemical formula being H_2O.

Water contains a great variety of substances, both mineral and organic, which it derives from the air and soil.

The amount of dissolved mineral matter contained in water depends upon the soil from which it is taken, some waters containing enormous amounts of mineral substances, salt, iron, and lime being most common.

"The permissible total amount of dissolved mineral constituents cannot be stated, but 50 parts in 100,000 are generally held excessive."[1]

[1] *Practical Hygiene,* Harrington.

In falling as snow or rain water absorbs both mineral and organic matter from the air. From the hygienic standpoint water is pure when it contains nothing injurious to health, and impure when it is unfit for domestic use.

Water may be classified into rain water, spring water, river, lake, and sea water, and artesian or deep well water.

Rain water is the purest of natural waters, but it absorbs impurities from the atmosphere through which it passes, hence its purity depends upon the locality of its falling.

Spring water is rain water which has penetrated the soil, and by its action of solution and oxidation may contain the chemical properties of the soil. Springs are divided into two classes, common and mineral, the latter often containing medicinal qualities of great value although unfit for domestic use.

Spring water is usually of lower temperature than the air, and contains few bacteria unless subject to special contamination.

Artesian or deep well water is of the purest, but contains the chemical properties of the strata through which it has passed, which may render it unfit for constant use.

Well water from shallow wells is easily polluted by surface washings and is usually hard, while spring water is soft.

River water and other surface waters such as ponds or small lakes are derived from the rainfall and from springs.

Water passing over rocky soil is less apt to contain organic matter than water which passes over a more porous soil or stands in marshy places, while water passing over or through sandstone contains more mineral substances.

The quality of surface water therefore depends upon the composition of the soil, season, rainfall, strength of the current, amount and character of surrounding vegetation, nearness and number of human habitations and other sources of contamination.

Water of Large Lakes. — The composition of lake water is variable, but broadly divided into salt and fresh water lakes.

The water of large lakes such as the Great Lakes of the United States is remarkably pure at a sufficient distance from shore to be unpolluted by sewage.

Sea water is of alkaline reaction and contains many chemical properties rendering it unfit for domestic or commercial use.

Impurities in Water. — The impurities contained in water are those substances which directly or indirectly may be injurious to health, and may be solid or in solution, gaseous, organic, or inorganic.

"It may be laid down as a general rule, regardless of the fact that all impurities do not necessarily breed disease or undermine the health, that all water containing or likely to contain domestic sewage, abundant growths of minute vegetable and animal organisms, decomposing matter of animal origin, dissolved vegetable matter of an inherently toxic nature or undergoing decomposition, or excessive amounts of mineral matter, should not be accepted as fit for human consumption. Especially should we bear in mind that water which is quite free from disease organisms and toxic matter to-day may contain them in abundance to-morrow."[1]

Mineral matter in water is usually connected with certain disorders such as follow the change from a soft to a hard water, which may cause constipation with an occasional attack of diarrhœa; or the change from a hard to a soft water, which may produce great looseness of the bowels. Goitre, a disease very common in Switzerland, France, and some parts of India, has long been attributed to mineral in the water, but recent investigations have made this theory doubtful, and while evidently due to the water is not due to its mineral contents. Lead poisoning from the action of water upon lead water pipes occurs not infrequently. Soft water and distilled water are said to be greater solvents of lead than hard water.

Organic pollution of water arises from dead organic vegetable or animal matter and living organisms, which may be either vegetable or animal. The sources of the organic pollution of water are from surface washings, the discharge of sewage into the water supply, and vegetable growths. The three infectious diseases which may be said positively to be carried by water are cholera, dysentery, and typhoid fever.

Yellow fever and malaria were formerly attributed to polluted drinking water, but recent investigations have proven that both are carried by other means. Cholera being an almost unknown disease in this country the epidemics of typhoid fever concern us most.

Contrary to a prevailing opinion, ordinary sewage pollution does not necessarily cause cholera nor typhoid

[1] *Practical Hygiene,* Harrington.

fever, the water must contain the specific germs of the diseases. Formerly it was supposed that the germ of typhoid was found only in the fecal discharges of the patient, but it is now known to be found in the urine for a much longer period, even after convalescence. In the country these discharges are usually deposited in the privy vault or upon the soil, in either case they are readily washed or filtered into the well or stream affording drinking water. Many outbreaks of typhoid fever have been traced from the locality in which they occurred to villages and towns higher up on the stream, discharging their sewage into the stream.

"In districts where water supplies are obtained from shallow wells, there is probably no more active cause of the spread of this disease than pollution of the soil by cesspools and privies. In such localities the soil is often saturated with the contents of privies into which not only normal intestinal contents find their way, but also the evacuations of individulas suffering from this malady. It is therefore plain that the most important domestic prophylactic measures consist in the disinfection of the bowel discharges from all suspicious cases of intestinal trouble and the subsequent disposal of such discharges by some method which will remove them quickly and completely from the neighborhood of human habitations. This latter is to be accomplished in cities only by an efficient sewerage system. In the country, where sewers do not exist, reliance must be placed in the disinfection of the stools and their final disposal upon the soil." [1]

[1] For examples of Typhoid Fever and Cholera Epidemics, see Harrington's *Practical Hygiene,* p. 379. *Hygiene of Transmissible Diseases,* Abbott.

Bacteria are found in all natural waters, but the important hygienic point is to determine whether the water contains the germs of any specific disease. The appearance of water may be extremely deceptive, as polluted water may be clear, sparkling, and odorless. On the contrary, pure water may be discolored from mineral or vegetable causes and frequently has an odor as well as an unpleasant taste.

The purity of water can only be determined in the laboratory.

The amount of water per capita daily supplied in a large number of cities in the United States varies from 300 gallons in Denver to 48 gallons in New Orleans, the average being about 150 gallons; this includes water for all domestic and commercial purposes.

The purification of water is accomplished by physical, chemical, and mechanical means.

Formerly mechanical means only were employed, a water that was clear being considered fit for drinking purposes, but with the knowledge acquired by recent investigations it is now known to be of much more importance to free the water of all pathogenic bacteria as well as of some harmful mineral substances.

Self-purification of Water. — That the water of running streams and lakes is largely self-purifying has long been recognized. This self-purification occurs by sedimentation or the settling of solid matter and by oxidation, whereby in its movement the water comes in contact with oxygen which oxidizes the organic matter; sunlight also destroys some bacteria.

The entrance of pure water from tributary streams dilutes polluted water, rendering it less harmful; many water plants purify water of undissolved organic substances, and pathogenic bacteria may be destroyed by the saprophytic class.

An interesting sample is cited by Jordan[1] of observations made along the Chicago drainage canal and its connecting rivers, the Des Plaines, Illinois, and Mississippi.

"In the flow of twenty-four miles between Morris and Ottawa, the river freed itself from a great mass of sewage bacteria with which it was originally laden, and at Ottawa this was not greatly in excess of that found in the flow of tributary streams."

However, self-purification is not sufficient to render water fit for drinking purposes which has been largely polluted.

Chemical purification is employed to cause an insoluble precipitate, which settles, carrying solid matters including bacteria.

Where excessive hardness of water is due to calcium bicarbonate (chalk), lime to the extent of fourteen or fifteen hundredweight to each million gallons of water is used. This is commonly practiced in the south of England where much of the water comes from chalk beds.

Alum, one grain per gallon, is sometimes employed to purify polluted water. "Although alum in large quantities is undoubtedly injurious to health, it is neither a violent nor cumulative poison; and the proposition that one part of alum in a million parts of water is injurious to health must be regarded as conjective rather than as a matter of proof, or even of probability." (Hazen.)

[1] *Journ. Exper. Med.*, Dec. 15, 1900.

Chlorin, in the form of chloride of lime, and bromin, in the form of bromide of potassium, are both used, but it has been proven that neither is satisfactory for sterilizing water upon a large scale.

Permanganate of potassium has been used for the purification of wells in India during cholera epidemics. Enough permanganate of potassium is dissolved and poured into the well to give it a pink color, which is repeated every twenty-four hours. The results claimed however have been disputed. Ozone applied to water by an electrical apparatus has been found the most efficient chemical method of sterilizing water, but the great cost of operation prevents its extended use.

Water is sometimes treated with borings and scrapings of metallic iron. Both water and iron being agitated by special machinery, a flocculent precipitate results, which settles, carrying the bacteria and organic matter with it; the water is then filtered through sand filters, the result being sterile water, but this also is an extremely expensive process.

Filtration of the water supplies of large cities has been found the most practical and efficient method of purification, and is extensively used in both Europe and America. The first filter beds for a public water supply were constructed in London in 1829 by Simpson to clarify the turbid water.

These beds, which except for unimportant detail were identical with those of to-day, were impervious basins built of stone and concrete with drains at the bottom covered with successive layers of coarse gravel and fine sand to half their depth, the sand forming the upper layer, the polluted water entering at the top. At first it was supposed that these filters acted only in a mechanical way as straining, but late investigations have proved that not only are solid mineral substances removed and the water made clear, but bacteria and other organic matter as well.

It was found that the first water passing through such a filter might be clear but not free from bacteria, but after several hours a fine deposit of sediment began to form upon the surface of the fine sand which proved to be capable of mechanically removing the bacteria. Still further, the organisms themselves "acting as saprophytes decompose the organic matter and even kill the pathogenic bacteria." [1]

Where the water supply comes from a turbid river, preliminary settling basins are used before filtration. It is extremely interesting to note that the modern process of sand filtration is identical with Nature's process which has been going on since the Creation.

Sand filters are cleaned by shutting off the water supply and allowing the basins to drain out completely. The draining of the water draws air through the filter which oxidizes much of the organic matter. The layer of sediment and an inch and a half or two inches of the upper layer of fine sand is then carefully scraped off. The frequency of cleaning is determined by the amount of sediment which gradually clogs the filter and by the daily bacteriological examination of the water, the latter being of first importance.

"An essential in the management of all large filters is the daily bacteriological and chemical examination of both filtered and unfiltered water. This not only serves

[1] *Hygiene and Sanitation,* Egbert.

to give warning of any accident to the filter, but is necessary, as the best test of the efficiency is the percentage of bacteria which it takes from unfiltered water. Unless a filter is holding back 98 to 99 per cent or more of the bacteria it needs close inspection, although it must be remembered that it is more difficult to get good results from badly polluted water than with one which is comparatively pure." [1]

It is the unanimous opinion of the best authorities that sand filters to be efficient should be provided in numbers to be used in rotation, that the finer the sand the better the filtration, that filter beds should be covered to prevent freezing in winter and the growth of vegetation in summer.

Where the water is very hard it is sometimes treated chemically before filtration. This method is employed in New Orleans where the water coming from the Mississippi River contains an enormous deposit of sediment. Three basins are employed, the first for settling, the second for mixing with alum, and the third for filtration. The filter beds here require to be cleaned daily or oftener, and the cost is estimated to be $600 daily for 40,000,000 gallons of water. This great labor and expense no doubt accounts for the small per capita allowance for New Orleans.

Domestic Purification of Water. — Properly all cities and towns having a public water supply should be in duty bound to provide pure water, thus avoiding the necessity of domestic purification except in villages and the country, but such a state of affairs has not yet obtained, and meanwhile every well-regulated house-

[1] *Hygiene and Sanitation,* Egbert.

hold not only observes its water supply, but provides some means for purifying it when necessary.

Too much stress cannot be laid upon the prevention of water pollution whether the supply be public or private. Where water is obtained from shallow wells it is not an exaggeration to say that more than half of them are polluted by the almost universal practice of depositing sewage upon the soil, and from the surface washings from privies and barnyards, all of which might easily be prevented by a little intelligent forethought. Impure water may be sterilized in small quantities for drinking and cooking purposes by boiling. After standing for an hour it should be strained through several thicknesses of clean cotton or linen cloth and boiled for one hour in a double boiler tightly closed. The use of the double boiler prevents the metallic taste so unpleasant when boiled in a teakettle. After cooling, the flat taste may be removed by pouring it several times from one vessel to another until aëration has occurred. Distillation is practiced in many places to secure pure water such as in the Navy and other ships, in hotels, hospitals, and other public institutions. In some distilling apparatus air is admitted into the condensers and aëration takes place with condensation.

Domestic filters of many kinds are upon the market, but the best authorities pronounce most of them useless or worse.

"According to Parkes the requisites of a good filter are: 1. That every part shall be easily accessible for cleansing or renewing the medium. 2. That the filtering medium shall have sufficient purifying power and be present in sufficient quantity. 3. That the medium give nothing to the water favoring the growth of low forms of life. 4. That the purifying power be reasonably lasting. 5. That there be nothing in the construction of the filter itself capable of undergoing putrefaction or of yielding metallic or other impurities to the water. 6. That the filtering material shall not clog and that the flow of water be reasonably rapid.

"The only domestic filters worthy of the name are those which remove mechanically all the bacteria of the water, and at the same time add nothing of their own substance to the water. Such are the Chamberland-Pasteur, the Berkefeld, and others based on the same principle. In these the filtering medium is unglazed, well-baked, hollow porcelain cylinders closed at one end like a test-tube, inclosed within a metallic or glass jacket with sufficient intervening space for the water, which enters directly from the tap under its usual pressure or 'head.' The open lower end of the cylinder discharges the water which passes directly through the walls of the cylinders or 'bougies' in the same way it would go through blotting paper. The material is such a very fine strainer that it excludes all suspended matters whatsoever. All these filtering tubes are purely mechanical in their action, and remove none of the matters poisonous or otherwise in solution. While they remove and retain on their external surface all the bacteria, they cannot prevent the growth of the organisms from without inward through their walls, and indeed this occurs so quickly that in order to secure absolutely sterile water continuously it is necessary to *clean and sterilize the bougies daily*, and thus it is advisable to have two sets, one of which can be cleaned while the other is in use." [1]

The cleansing of filter tubes consists of thoroughly scrubbing the outside followed by baking or boiling for at least an hour.

It is safe to say that far greater danger to life exists in an unclean filter than is found in any ordinary water supply.

ICE

It was formerly supposed that freezing freed water of all of its impurities, but such is not the case, as many varieties of bacteria, notably that of typhoid fever, retain their vitality in ice for a very long time.

Several epidemics of typhoid fever have been traced to ice cut from polluted ponds and rivers. Artificial ice is often represented as being absolutely pure, but unless it be made from distilled water or sterilized water it is open to the same suspicion as natural ice.

[1] *Practical Hygiene,* Harrington.

CHAPTER V

SEWAGE, GARBAGE

DOMESTIC sewage is a mixture of urine, feces, paper, the waste from bath and laundry tubs and from kitchen sinks, while industrial sewage is entirely different.

The sewage from manufacturing centers often contains chemicals or other substances destructive to fish life, and may contain as much or more organic matter than domestic sewage, but the latter is liable to hold discharges from infectious diseases which are a menace to the public health.

Removal of Sewage. — Sewage may be removed by water or the dry method.

The removal of sewage by water necessitates a system of plumbing which should be of the best possible method of construction and material. The best plumbing is by far the most economical not only in the health of a household but in the expense of repairs.

A good system of plumbing calls for sound materials, absolutely tight joints, thorough ventilation, and a plentiful supply of water to insure thorough flushing without wastefulness.

To this may be added that plumbing should have good daily care. Many bad odors are attributed to sewer gas which in reality are simply filth, easily removed by a thorough scrubbing and flushing with *clean* hot soapsuds to which has been added a handful of washing soda. Long-handled sanitary brushes for cleaning the basins of water-closets will frequently remove "sewer gas" most effectively.

Modern plumbing is "open plumbing," *i.e.* not put into walls nor between floors, but made with all pipes, joints, and traps in plain sight except where necessary to go through walls or floors, thus giving an opportunity to detect leaks, securing ventilation and making repairs an easy matter.

The Soil Pipe. — The soil pipe receives the sewage from the waste pipes from water-closets, bath and laundry tubs, kitchen and housemaids' sinks. This

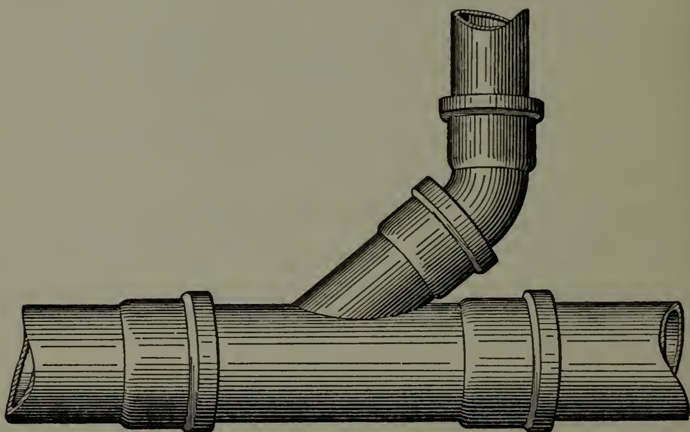


Fig. 2. — Connection of soil pipe to house drain.

pipe should be four inches in diameter for a dwelling and larger for hospitals or other larger buildings, made of heavy iron, and should be as straight as possible, extending at least two feet above the roof without a cowl to cover it. The unavoidable bends should be obtuse, not right angles, and the entering waste pipes also should never be at right angles.

In warm climates the soil pipe should be on the outside of the wall rather than the inside; it should be in or near the water-closets to avoid carrying the waste pipes beneath the floors where leaks are difficult to detect or repair.

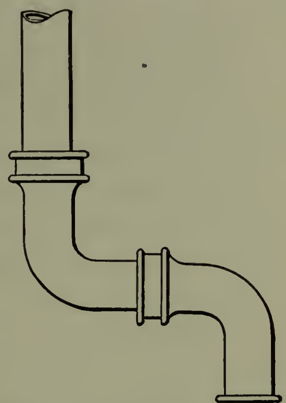
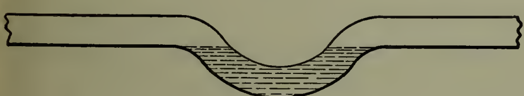


Fig. 3. — Improper bends in soil pipe. (Harrington.)

The tendency of modern plumbing is to simplify all fixtures; a great improvement to the soil pipe is in the flanged ends which secure easy adjustment and reduce the danger of leaks to a minimum.

Traps. — Traps are devices to prevent the return of sewer-air through the waste pipes into the building. The simplest trap is made by a bend or bends in the pipes, downward in a horizontal pipe and a figure S in a perpendicular pipe.

When water passes through the pipes some of it will



RUNNING TRAP

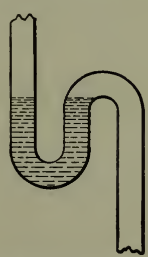


FIGURE S TRAP

be retained in the depressed parts, causing a water seal, which prevents the return of sewer air.

There are several other traps of excellent design in common use, the ball-trap, bell-trap, bottle-trap, Anti-D trap, and Mason trap. Each and every waste pipe from all water-closets, sinks, wash basins, and laundry tubs must be trapped, the trap always being put as near the fixture as possible.

Traps lose their seal by siphonage, evaporation, leakage, and the accumulation of sediment in the trap.

Siphonage is prevented by ventilating pipes from the trap, which connect with a main ventilating pipe.

Evaporation of the water seal usually results from disuse, and may be prevented by pouring glycerine or some oil into the pipes when a building is to be closed for some time.

Water-closets should always be lighted and ventilated by windows. The old practice of placing such plumbing in unlighted, unventilated closets literally belonged to the dark ages.

Preferably the plumbing should be put opposite the window, which gives a better light for detecting leaks and making repairs. The best forms of closet in use at present are the short hopper or some form of washout or washdown with flushing rims and a generous flow of water.

Every water-closet should be supplied with a long-handled sanitary brush to immediately remove any accumulation of filth on the sides of the closet basin which does not yield to the flushing.

Wash basins and bath tubs were formerly supplied with overflow pipes opening from the top of the basin or tub; these pipes are particularly objectionable, as they collect filth and soon become foul smelling, and are almost impossible to clean, while in some cases they discharge into the waste pipe *below* the trap which allows sewer air free passage into the room. The newer arrangement of standpipe overflow is preferable in every way.

Sinks. — Kitchen, pantry, and slop sinks should be made of impervious material, perferably porcelain or iron heavily enameled, or slate. All such sinks require the best of daily care. Slop sinks from the nature of their use should have particular attention to prevent foul odors; they should never be placed in dark closets, and should always be provided with a flushing rim, and in hospitals special fixtures for flushing bedpans should be provided. One of the especial reasons why slop hoppers, particularly in hospitals, become so foul is because they are too small, and their sides as well as the walls and floors are splashed with slops. Soda solution, about 5 per cent boiling hot, will remove much greasy sediment and remove most odors except that of urine, which can be neutralized by the use of a 10 per cent solution of hydrochloric acid followed by plenty of water. The discharge pipes from all sinks as from all water-closets should be in plain sight and never inclosed in cupboards.

With good plumbing and good daily care, odors of any kind are never present.

Final Disposal of Sewage. — Sewage is finally disposed of by discharging into the sea, into streams, by the dry method, by chemical treatment, by filtration, by sewage farms or irrigation and several other methods.

In the country, where no sewerage system prevails, the sewage discharges into a cesspool. If the cesspool is far enough from the well and the soil is porous, the cesspool may be built to allow the fluids to drain away into the soil at once, if not, the cesspool must be built of impervious material which necessitates frequent cleaning, the solid contents being used as fertilizer.

A large majority of towns discharge their sewage *into running streams*, a custom which in time will no doubt be prohibited with all streams which serve as a water supply.

Sea-coast towns find the disposal of sewage an easy matter, as the elements of sea water cause a precipitation of solids, and the tide dilutes and carries the impure water away.

Dry Method. — The dry method for the removal and disposal of sewage is known as the pail system or earth closet, and is used very little except in the country or in the far northern latitudes (Christiania, Norway), where the freezing of water pipes prevents the removal of sewage by water.

When used in cities the pail is a divided one, or there is a separate receptacle for urine. Dry powdered earth, peat, ashes, lime, sawdust, and land-plaster (pulverized gypsum), are all used as deodorants, a supply being kept in the closet, each addition to the pail being covered at once.

From the custom of removal by night, this sewage came to be known as night-soil.

The night-soil from cities is usually treated chemically and either buried or spread upon the soil as manure.

By investigation it has been found that the earth may be dried and used repeatedly, as it purifies itself in time.

The chemical treatment of sewage is accomplished by passing the sewage through coarse screens and treating it with alum, lime, sulphate of iron or clay, besides other combinations of chemicals. The precipitate, called sludge, is used as a fertilizer, and the remaining fluid is discharged into streams, in some cases being previously sand-filtered as was described for drinking water.

"The conditions necessary for success from chemical treatment are as follows: —

"1. The sewage should be treated while fresh.

"2. The chemicals should be added to the flowing sewage and thoroughly mixed with it before it passes into the settling tanks.

"3. There should be a liberal amount of tank space.

"4. The arrangements for the removal of sludge should be such as to insure its frequent removal."[1]

Sand filtration of sewage consists of discharging the sewage into especially prepared sand filters which are used in rotation, one half day at a time, to allow for the entrance of oxygen and give the saprophytic bacteria an opportunity to convert the organic impurities into simple compounds.

The land is under-drained at a depth of five or six feet; an acre, it is said, will purify the sewage from 2000 persons, and of 5000 persons when the sewage has been chemically treated or "settled."

By the irrigation method of disposal the sewage is discharged upon the land for fertilizing purposes. This method is employed in a large number of English towns and in Berlin and other German cities.

In the United States it has been adopted in few of the smaller cities except in Colorado and California, where a number of the cities utilize the sewage for irrigation purposes. Such a method is not adaptable for large cities in this country where adjacent lands are so expensive and not always of the proper quality for the pur-

[1] *Principles of Hygiene,* Bergey.

pose, and if there is not enough land the soil becomes heavy with filth and unproductive as well as dangerous. Also in cold climates such an arrangement is not satisfactory. In Madras, India, the climate being very hot eight crops a year are taken from the "sewage farms." It is said that the health of those living near the sewage farms does not suffer.

"An extensive outbreak of typhoid fever in Paris would be supposed to be the forerunner of another of greater comparative severity, where its sewage containing all the bowel discharges and urine of sick and well alike is treated; but experience has demonstrated that such is not the case, for in 1882, for instance, when Paris suffered from an unusually extensive outbreak of that disease, there was not a single case at Gennevilliers." [1]

The reasons given for this are that the saprophytic bacteria destroy the organic matter and the pathogenic organisms, and the water is taken up by the growing vegetation or filtered through the soil before entering the streams, Nature's own perfect method of purification.

Irrigation upon a small scale for country houses or small hamlets consists of discharging the sewage into a reservoir through a wire basket, and from there through three or four outlets made of porous drainage tiles as in any underdrain; in this way the sewage is utilized for fertilizing lawns or gardens. Several other methods and combinations of methods are used, notably the Cameron "Septic Tank" process, which, contrary to the usual procedure, treats the sewage after it has been stored away from light and air until the organic matter has broken down, when it is drained into open air tanks and filtered.

[1] *Practical Hygiene,* Harrington.

GARBAGE

By garbage is meant all the waste material from a household, such as kitchen refuse, ashes, sweepings, paper, old shoes, dishes and cooking utensils, clothing, etc. Of these the kitchen and stable refuse in large cities are the most important, as any accumulation soon becomes a menace to health.

In well-regulated cities, kitchen slops are kept separate from ashes and other dry refuse, the former being collected daily and the latter twice or thrice weekly.

The following form of ordinance covers the regulations in force in New York, Boston, and other cities.

"Section 1. That it shall be unlawful for any person or persons to keep in his house or on his land any kitchen garbage or offal unless the same is placed in water-tight vessels free from ashes and other refuse matter (except food cans and food bottles).

"Section 2. No person shall place or keep in or near any building, ashes or cinders in such a manner as to cause fire, nor mix them with other substances nor place or keep them except in metallic vessels so placed as to be easily removed.

"Section 3. All other refuse such as paper, rags, excelsior, straw mattress, old clothing, pasteboard boxes, carpet and other household waste shall be kept in suitable vessels free from ashes and garbage, or in bundles firmly fastened so as to prevent rubbish from being scattered in handling, and protected from the weather until collected by the proper authority.

"Section 4. Ashes placed out for removal, shall be moistened sufficiently to keep down the dust while handling and placed within 4 feet of the building line in vessels which will hold their contents without spilling; shall be placed out only on the day set for their removal, and taken in when emptied of the r contents."

Disposal of Garbage. — There are several methods for the final disposal of garbage.

In the country it is a simple matter if properly managed, as all kitchen refuse may be fed to poultry or farm animals, all dry refuse may be easily burned out-of-doors, and cans, bottles, and old iron buried, where tin and iron speedily disintegrate. Glass should always be buried to prevent accident to the feet of both men and animals. In large towns and cities, however, the disposal of garbage becomes a serious question both from a hygienic and an economic standpoint. It is safe to say that one half or more of the enormous expenditure now required of most cities might be avoided if every household and manufactory looked after its garbage as it might.

A large amount of kitchen and other refuse could easily be burned in the range or furnace, and if done immediately would give rise to no worse odors than comes from cooking.

An ingenious device for burning kitchen refuse is used in many households, consisting of an enlarged portion of the pipe of the kitchen range, having a door, into which is put a wire basket containing the refuse, which is soon dried of all moisture and reduced to a charcoal and may be used for fuel. No odors escape into the room, and there is no interference with the draught.

For hospitals and other large institutions, portable furnaces have been devised which are simple and satisfactory, eliminating bad odors and requiring little extra fuel.

The garbage from large cities is dumped into the sea or upon the land, the kitchen refuse is sometimes sold to farmers for feeding to swine, or the whole is sorted and what cannot be sold or utilized is destroyed or reduced in especially built furnaces called "destructors."

Dumping garbage into the sea is particularly objectionable, as with favoring winds and tides a large proportion of it is thrown upon the neighboring beaches, where it is not only unsightly and offensive but puts an end to sea-bathing.

Dumping upon the land is perhaps a shade worse, as it becomes offensive to a vast area which surrounds the "dump grounds."

The disposal of slops or "swill" to farmers is also offensive, giving forth foul odors and usually leaking along the highway. This practice usually means that such slops must wait for cartage, which results in their putrefaction and accompanying indescribable odors.

Incineration has been successfully carried on in England for many years.

The garbage is sorted and much of the refuse, such as old rubber, leather, and woolen goods, is sold, also the solder from tin cans. Old furniture, paper, and pasteboard is used for fuel in the furnaces which burn the other garbage. These furnaces not only cremate the refuse but destroy the foul vapors and gases arising from the combustion; this point is essential, otherwise they become public nuisances. It is said that the experiment has failed repeatedly in the United States for this reason, although where properly managed the process has proven entirely satisfactory.

The reduction of kitchen garbage is accomplished by taking the garbage while perfectly fresh and allowing most of the moisture to drain into the sewer. Live steam is then turned into it for six hours, when it loses about three fourths of its weight in vapor, which is turned into condensers and finally into the sewer. The grease is removed from the remaining solid matter, which is then dried and sold for fertilizer, both being a source of considerable revenue.

Large incinerators or reduction works should be located at some distance from the city, as foul odors cannot all be eliminated.

CHAPTER VI

CAUSES AND DISSEMINATION OF DISEASE

Pathology is the science which explains the origin, causes, history, and nature of disease.

Etiology is the subdivision of pathology which treats of the causes of disease.

Prophylaxis is the use of precautions to prevent disease; "its first function of suppressing or removing predisposing conditions is accomplished by *sanitation;* the second, that of destroying or modifying exciting causes, is carried out by *disinfection*. . . .

"We may, therefore, say that sanitation is the defensive, and disinfection the aggressive part of prophylaxis."[1]

The causes of disease are usually broadly divided into two classes, direct or exciting causes, and indirect or predisposing causes or conditions.

Of the **direct causes** there are chemical, such as poisons; physical, such as heat or cold; mechanical, such as injuries; and vital, such as the parasites and bacteria of certain specific diseases.

"An organism capable of producing disease we call *pathogenic or infective,* and the process by which it produces disease we know as *infection*. Diseases therefore that depend for their existence upon the presence of bacteria in the tissues are *infectious* diseases."[2]

The indirect or predisposing causes of disease are

[1] *Hygiene and Sanitation,* Egbert.

[2] *Hygiene of Transmissible Diseases,* Abbott.

age, sex, heredity, race, occupation, and habits. As an illustration[1] "the direct cause of tuberculosis is *Bacillus tuberculosis*, while the indirect or predisposing causes may be numerous — as age, race, occupation, unsanitary surroundings, and heredity."

Resistance to Disease. — Individuals vary greatly in their degree of resistance to disease. It is known that certain cells and substances of the blood called *opsonins* are antagonistic to pathogenic bacteria, — "the individual infected owes his resistance to four main protective powers of the blood. These four protective agencies are in character: (1) bactericidal, or having the power to kill bacteria; (2) bacteriolytic, which includes not only the power to kill but to dissolve bacteria; (3) agglutinating, or possessing the power to produce clumping of bacteria; (4) phagocytic, or the power of leucocytes (white blood corpuscles) to engulf and digest bacteria." [2]

The degree of resistance to certain disease germs is determined by the examination of the blood and is known as the patient's opsonic index.

Anything which lowers the general health of the individual, such as dissipation, exposure, lack of food, overwork, or unsanitary modes of living, must necessarily lessen the resistance or, as it is expressed, lower the opsonic index. This is commonly illustrated when certain infectious diseases such as scarlet fever or typhoid fever are present in a community. Not all children exposed to scarlet fever at the same time contract the

[1] *Hygiene of Transmissible Diseases*, Abbott.

[2] See *Opsonic Index* and *Vaccine Therapy* by Ruth Vail, M.D., and Mary C. Lincoln, M.D. *American Journal of Nursing*, Nov., 1907.

disease, neither do all persons who drink typhoid-infected water or milk have typhoid fever, the reason being in the difference of the susceptibility in different individuals. A person who is not susceptible to the pathogenic (disease) germs of a specific disease, such as smallpox, is said to be immune. Immunity may be natural or acquired; natural in the case of man's resistance to hog cholera and of cattle to typhoid fever. Acquired immunity usually follows one attack of certain infectious diseases, as in smallpox, scarlet fever, or yellow fever. Vaccination to prevent smallpox produces an acquired immunity. The use of an antitoxin serum to prevent diphtheria is also an example of acquired immunity, which is temporary, usually lasting about three weeks.

Preventive inoculation with sterilized cultures of the bacilli of typhoid fever, bubonic plague, and cholera has been practiced to a limited degree with varying success.

Age. — The highest death rate occurs among the very young and the very old — before five and after sixty-five years of age.

Young children suffer from disorders of digestion, catarrhal affections, congenital (existing at birth) defects, the effects of bad air and lack of cleanliness, and certain acute diseases, as scarlet fever, diphtheria, measles, and chicken pox.

Tuberculosis in many different forms also affects children as well as adults, it being one of the diseases common to all ages.

Typhoid fever occurs most frequently between the ages of fifteen and forty-five.

Erysipelas, smallpox, and typhus fever are common to all ages.

Hughes cites "heart, kidney, digestive disorders and cancer as common to middle age. Degeneration of the heart and blood vessels to old age."

Persons leading regular lives with proper food, shelter, cleanliness, and clothing may be comparatively safe from disease, while on the contrary bad air, overcrowding, bad or insufficient food, intemperance, exposure, and unsanitary occupation lower the vitality and resistance, and render men susceptible to sickness.

Sex is not only a predisposing cause in the diseases peculiar to the anatomical differences in the sexes, but the statistics of general death rates show almost uniformly a lower rate among women than men; which is explained by the fact that the daily life of men exposes them more to disease and accident.

Abbott cites the statistics regarding cancer, anæmia, and typhoid fever, which illustrate the influence of age and sex upon mortality.

Deaths among the white population of New York City from Anæmia, Typhoid Fever, and Cancer during the six years ending May 31, 1890, *with distinction of age and sex.*

	Anæmia		Typhoid Fever		Cancer	
	Males	Females	Males	Females	Males	Females
Under 15 years	22	27	152	138	24	24
From 15 to 40 years	18	46	828	526	222	560
Over 40 years	19	37	213	148	1299	2653
Totals	59	110	1193	812	1545	3237

Race. — Certain differences in the susceptibility to disease are observed in the races, this being particularly noticeable in comparing the whites and blacks.

The negro is less susceptible to malaria and yellow fever than the white man, but is more liable to cholera, while the Chinese are the least susceptible to cholera.

Statistics of the New York census (1890) show that "consumption, pneumonia, heart disease, puerperal diseases and diseases of the urinary apparatus were found to be more fatal among the negro than the native white population." The immunity of the Jews from disease and their longer duration of life has been observed in many countries.

Giving the male Jewish death rate from Consumption, Scrofula, and Hydrocephalus per 1000 *total deaths from known causes, as compared with the rates similarly calculated for the entire population of the United States in* 1880 *and for that of Massachusetts in* 1888:[1] —

Diseases	Jews	All United States, 1880	All Massachusetts, 1888
Consumption	36.57	108.79	129.22
Scrofula and tabes	1.04	6.74	30.60
Hydrocephalus	3.13	6.43	11.74

Occupation. — Certain occupations predispose to disease by the conditions surrounding them.

The inhalation of dust from fabrics, minerals, and hard woods are conducive to diseases of the lungs, while singularly enough the dust from coal seems to be harmless. Dust also is a carrier of infection.

Soldiers, sailors, and fishermen are exposed to extremes of temperature and moisture.

The overwork and underfeeding common to many occupations is another important factor in causing disease.

Lead poisoning occurs with painters and plumbers,

[1] *The Vital Statistics of the Jews of the United States*, Billings.

"brass-founder's ague" with workers in brass and zinc, while other chemical poisons are common to dyers and workmen using arsenic and the anilin dyes. The inhalation of gases from iodine, ammonia, chlorine, and many other chemicals used in various industries is more or less injurious to health.

Occupations which compel a cramped position, especially when in dark, badly ventilated rooms, are a menace to health.

Crowding. — It has long been a matter of observation that the greater the density of population the higher the death rate.

Overcrowding is a necessary condition of poverty which usually entails beside poor and insufficient food, bad air, lack or entire absence of facilities for bathing or laundry work, imperfect lighting, and the easy dissemination of infectious diseases owing to close contact.

"The more crowded a community, the greater, speaking generally, is the amount of abject want, of filth, of crime, of drunkenness, and of other excesses, the more keen the competition and the more feverish and exhausting the conditions of life. Moreover, and perhaps more than all, it is in these crowded communities that almost all the most dangerous and unhealthy industries are carried on. It is not so much the aggregation itself, as it is these other factors which are associated with aggregation, that produce the high mortality of our great towns, or other thickly populated areas." (Ogle.)

Heredity may be defined as the influence of parents upon offspring. The question of the direct transmission of diseases from parent to child has long been a subject of controversy; syphilis and some of the acute infections are doubtless transmitted directly, but in regard to tuberculosis authorities differ.

"In predisposing to disease heredity manifests its influence more through the transmission of a peculiar habit of body than by the transmission of the disease itself. . . . In some families we observe a peculiar tendency to nervous diseases, as to epilepsy or insanity; in others to cancers and tumors; in others to scrofula and other tubercular manifestations. Again, families are encountered that are endowed with a marked predisposition to acute diseases and in others there is an equally marked resistance to them. In short, the inheritance of a tendency to, or immunity from, disease is due fundamentally to the same processes, through which peculiarities of a physical, moral, or mental nature are transmitted."[1]

The season exerts an influence upon the prevalence of certain diseases.

The summer months show a large proportion of diseases of the digestive tract, especially in young children, probably due to the speedy decomposition of milk, meat, and perishable fruits and vegetables.

During the colder months, catarrhal affections, acute infectious diseases, and diseases of the respiratory system are more prevalent. It is still a question how much of this winter illness is due to the cold and moisture, and how much to the effects of lack of ventilation and cleanliness, which are common in winter.

Malaria and typhoid fever are both more prevalent in the early autumn than during the rest of the year.

Dissemination of Disease. — In all contagious and

[1] *Hygiene of Transmissible Diseases*, Abbott.

infectious diseases the transfer of the disease germs is accomplished either directly from a patient to another individual, or indirectly through the air, water, food, or insects.

"**Air-borne Germs.** — To this class belong the eruptive diseases, such as measles, scarlet fever, smallpox, erysipelas, chicken pox, also diphtheria, tuberculosis, and mumps. Besides the danger from the discharges and secretions being deposited upon bedding, floors, or utensils, and becoming a direct menace to others, there is the double danger of such discharges becoming dried and blown with dust to greater or less distances, and the still greater danger of the so-called 'droplet' infection. It has been demonstrated that in talking, coughing, sneezing, and even in rapid breathing numerous germ-laden bubbles or droplets of mucus or saliva pass into the air, where they may float about for some time. In the case of pulmonary tuberculosis the greater danger would then be from patients still able to walk about, rather than with the bedridden.

"Air-borne infection is, therefore, most dangerous in close, badly ventilated rooms or wards.

"**Water and Soil.** — Infections borne by water are typhoid fever, cholera, and dysentery. The soil also may bear the bacilli of tetanus (lockjaw), cholera, and typhoid fever.

"**Food.** — Infections borne by food, such as milk, meat, oysters, and fruit, are tuberculosis, typhoid fever, cholera, and the summer diarrhœa of children.

"**Insects.** — Infections borne by insects are malaria, yellow fever, typhoid fever, and tuberculosis; mosquitoes, house flies, and bedbugs being the common carriers."

In the case of mosquitoes which carry malaria and yellow fever, the person is infected by the bite of the insect; while house flies and bedbugs carry the disease germs upon their feet and bodies and by their contact with water, food, or eating utensils convey it to other individuals.

In Cuba, yellow fever and malaria have been entirely stamped out by the destruction of the mosquitoes, which was accomplished by drainage, by the use of petroleum upon the surface of standing water, and by laws forbidding any vessels for water being left standing open. It was found that the peculiar type of mosquito which serves as the carrier of malaria and yellow fever, breeds more frequently in open vessels of standing water than in marshy places.

Vermin such as rats and mice are considered a grave source of danger in carrying cholera and bubonic plague.

Domestic pets such as cats and dogs no doubt often carry in their fur the germs of scarlet fever, smallpox, and other eruptive diseases.

"**Inoculation.** — Infections by inoculation are leprosy, syphilis, vaccina, ophthalmia, gonorrhœa, tetanus, anthrax, puerperal fever, tuberculosis, hydrophobia, pyæmia, and septicæmia."

Disease is said to be *epidemic* when it prevails in a community: it is *endemic* when it is peculiar to a people or a nation, and *pandemic* when it is widespread over more than one country. Influenza is the best example of a pandemic disease.

CHAPTER VII

PERSONAL HYGIENE [1]

Good health of mind and body depends upon the perfect work performed by all the organs of the body. In order that these organs may exercise their proper functions, the individual must lead a rational, hygienic life.

No hard and fast rules can ever be made which will fit every individual, but certain general principles must be observed by all; otherwise sooner or later the penalty is paid in impaired health.

It is a lamentable fact that the bulk of humanity have little real knowledge of their own bodies, the greater proportion of them having a morbid fear of "taking cold" and "overwork," while an unhappy number fix their attention upon the disorder of some certain organ, to the detriment of their peace of mind and vigor of body.

A good example is the very common form of fermentative dyspepsia, due largely to overeating and imperfect mastication, that is often accompanied with palpitation of the heart, which in the mind of the ignorant victim at once becomes "heart disease," who stops work and exercise for fear of the consequences to the heart. Such

[1] For further instruction to nurses, see *Primary Nursing Technique,* McIsaac, Chapter I.

a person if better informed would curtail the quantity of food, practice better mastication and take more instead of less exercise.

The fear of taking cold leads to overheated, illy ventilated houses, and it seems hopeless to convince many that cold baths and open bedroom windows prevent instead of causing colds.

"Overwork" is a bugbear which is greatly magnified in most minds; indolence both mental and physical causes as much illness as overwork. When overwork does occur, it is usually the result of concentration upon one particular kind of occupation, to the exclusion of all other interests, and of recreation and rational exercise, together with bad or insufficient food. Factory workers afford a good example of such conditions.

If the children can be taught physiology properly, a great work in the prevention of disease could easily be done; but an adult man or woman usually has fixed habits, accompanied by some pet ailment, and both combined with crass ignorance of the simplest functions of the body, make it a hopeless task to enlighten them.

Physiology as commonly taught to children is of very little practical use; to teach a child of twelve the names of all the bones of his body and say little or nothing about his excretions stands for nothing. Too much time is devoted to the pernicious effects of tobacco and alcohol and too little to the evils of constipation, overeating, and lack of cleanliness.

The appalling consequences of ignorance in the relation of the sexes, have become such a serious menace to the physical and moral health of the human race, that with one accord medical authorities, parents, and the clergy are striving to teach the coming generation what they should know in order to respect their own bodies.

It lies within the hands of nurses to wield a great influence toward a better knowledge of physiology, both as a factor for better health and for better morals.

Habitation is a great factor in the preservation of health. The subject is considered elsewhere (p. 117).

Cleanliness of body is equally important with cleanliness of surroundings; a clean, wholesome body not only stimulates physical vigor, but produces mental activity as well.

It is very seldom an active mind is associated with an unclean body, while moral delinquency is almost invariably coupled with personal uncleanliness.

The mental and moral inertia of the "unwashed" is in daily evidence in all walks of life. It is an easy matter to teach a child to be clean, but adults are hopeless unless the appeal to their vanity has an effect.

Baths play an equally important rôle in the prevention and cure of disease.

Frequent baths, daily if possible, for cleanliness, and the cold shower in the morning, with an abundance of clean clothing, are a necessity as well as a luxury.

Houses without running water may easily have plenty of cistern water, and with a portable tin tub frequent baths may be taken with very little trouble.

Children who become accustomed to the warm bath for cleanliness, followed by a cold shower, seldom depart from their good habit in later years, but many adults are unable to begin the cold shower baths.

Hot baths relieve the muscular soreness following great exertion or fatigue, while a cold shower bath refreshes greatly.

For nervous irritability in children or adults, a warm bath continued for 20 or 30 minutes has a quieting effect.

Exercise. — It is essential for the maintenance of health that the body shall be exercised in all its parts.

Rational physical exercise develops not only the muscles, but affects all the organs of the body; the heart, lungs, skin, kidneys, brain, and digestive apparatus are all stimulated. Excessive exercise may injure the heart, but deficient exercise produces obesity and tends to weaken the heart and "is a common cause of morbid excitability manifested by irritability of temper, sensitiveness, and that form of nervous unrest known as fidgets." (Harrington.)

The amount and kind of exercise necessary depend upon the occupation and surroundings of the individual. The farmer or gardener will scarcely need further exercise than his work, while the man tied to an office desk or any sedentary occupation needs systematic out-of-door exercise. Golf, gardening, sailing, tennis, wheeling, and horseback riding are usually advised for those confined by business indoors; the pleasure derived from these forms of exercise no doubt is as great a factor in improved health as the exercise itself.

Rest and recreation are indispensable for every human being. Monotony combined with overwork is doubtless the cause of much mental and nervous disturbance, statistics showing that a high percentage of insanity is among farmers' wives. The isolation and monotony, together with the laborious work and childbearing, combine to bring mental disaster which might easily be avoided if as much thought was given to the welfare of the mother as is given to the cattle on the farm.

Worry is far more often a cause of mental and physical disorders than mental activity, and as worry is often the outcome of monotony, recreation may be said to be its preventive.

The importance of rest and recreation to nurses can scarcely be emphasized sufficiently. During the term of training, the association with many other nurses, the study and interest in new work, and the regularity of the routine tend to improve the general health, but graduate nurses engaged in either private or hospital nursing, very frequently fall into a monotonous round of living devoid of recreation, which speedily manifests itself in nervous unrest, depression, and in some cases true melancholia.

The necessity which compels nurses to live weeks and months in an atmosphere of illness is naturally depressing, making it an imperative necessity for them to take rest and recreation at frequent intervals, and that their home surroundings when off duty should be particularly bright, comfortable, and cheerful. Hard work, mental or physical, is seldom injurious to health when done under favorable conditions; but grinding monotony, with no outside interests, will soon affect the spirit of the individual, which in time injures the general health.

Sleep. — Every human being seems to be a law unto himself regarding the amount of sleep required, although it has long been conceded that eight hours out of the twenty-four is needed by the average adult between 20 and 50. Children and the aged require more, and men can endure loss of sleep better than women, some authorities stating that if a man requires 8 hours a woman requires 9. That many women suffer loss of health from lack of sleep and regularity, is evidenced by their speedy recovery when compelled to take the "rest cure." Late, irregular hours and lack of sleep are especially harmful to children, although slothful habits of sleeping twelve hours or more, with the consequent loss of a regular breakfast, are nearly as bad.

Mental Attitude. — The mental attitude of the individual is a factor in good health; a busy, cheerful mind lends great aid to digestion, while a morose, despondent temperament has a reverse effect.

The so-called "mind cure" is a subject which is widely ridiculed, but it has in its claims some elements of truth which cannot be disputed.

In youth and in fair health the mental attitude is largely under control of the will, and just as the muscles of the body require exercise to attain a high state of development, so the mind and spirit require exercise and control. A child who is taught self-control seldom loses the habit in adult years.

Doubtless the habits of worry and fear undermine the vigor of a very large number of persons who otherwise might be strong and well.

The digestion is easily disturbed by the state of mind; worry, fright, and anger arrest digestion, while cheerfulness promotes it.

Diet. — Moderation in quantity and quality of food is one great factor in preserving health. It is not possible to establish dietaries which are suitable and satisfactory to all persons.

Extreme "fads" either in quantity, quality, or variety are almost invariably harmful.

Good teeth and thoroughly masticated food are important factors, while good cooking, service, variety, and moderate amounts make up the general rules which should govern one's daily food.

Clothing. — In the selection of proper clothing the comfort of the individual should have more consideration. Women err in this respect more than men, and the discomfort of heavy, constricted garments is productive of much nervous irritability which is wholly unnecessary. This is especially true in the case of nurses, teachers, and others whose occupation is for a number of consecutive hours, which admit of no relief from their uncomfortable clothing. Well-to-do mechanics often afford an excellent example of the suitability and comfort of clothing which is entirely wanting in the case of their wives.

The danger of the transmission of disease germs in clothing and all fabrics, such as bedding, carpets, rugs, and curtains, is well known and should be guarded against.

Excretions. — The daily evacuations from the bowels and activity of the kidneys and skin have a great influence upon health.

Bathing stimulates the action of the skin as well as removing the sweat and débris.

The movements of the bowels are regulated largely by the nature of the food taken and the occupation, but at least one movement daily is an absolute necessity or the accumulation of fecal matter is reabsorbed and productive of disease.

Few persons drink enough water to flush the kidneys and dilute the waste secreted. At least 3 pints of water daily for an adult is necessary.

CHAPTER VIII

HOUSEHOLD HYGIENE

In considering household hygiene the subjects of food, water, ventilation, plumbing, sewage and garbage, heating and lighting have already been spoken of in special chapters, as well as personal hygiene.

The practice of hygiene in the household may be said to be good housekeeping, or the observance of such hygienic methods as shall bring all of the foregoing factors into their proper relation to the health of the family.

The House. — The city dweller has little choice in the selection of the site of his habitation, but the country or small town resident has a much wider range, which he often completely ignores.

A house should stand upon well-drained soil, for nothing damp in walls or cellar should be allowed to encourage rheumatism, kidney disorders, tuberculosis, or depressed spirits.

Position. — If possible a house should stand with its four corners (not sides) to the points of the compass, preferably to face southeast or southwest; in this way the sun may enter the windows of every room.

Sunlight. — In crowded cities where a large proportion of the people must live in small quarters, the absence of sunlight is unavoidable, while in smaller cities, towns, and the country it is inexcusable; but any observant person taking a railway journey across the continent, cannot help being appalled at seeing the innumerable number of houses with windows tightly closed, shades drawn down to keep the carpets from fading, and as a crowning offense to health, outside shutters at the windows, excluding every ray of light.

It is not too much to say that country people suffer as much from lack of light and ventilation as the dwellers in cities; one might say more, because the majority of city people are being constantly reminded of the danger of close contact and bad air, while in the country the fact that pure air is abundant seems to be thought sufficient, and little effort is made to obtain a supply for indoor use. The dullest woman knows that plants do not thrive without the sun and air, and why so many of them deny their children the same privileges seems hard to understand.

Bedrooms are better for being on the east or south side of the house, where the sun in the earlier part of the day may shine upon open beds.

Closets for clothing, which are without windows, should preferably have the doorways screened by washable curtains rather than the solid doors; the curtains may not keep out as much dust but they admit the air, which is more essential.

Bath rooms and water-closets must have windows or extra large ventilating shafts to be at all sanitary.

Kitchens should be bright and comfortable, as some person or persons must spend most of the day in the kitchen of every household, and a dark, badly ventilated, inconvenient kitchen is depressing to both the cook and the cooking.

Porches should not be too wide nor numerous to shut off air and light.

Stairs should be broad and easy to mount. There should be no different levels in the rooms; one or two extra steps between rooms, mounted many times daily, soon become very fatiguing.

Ceilings had better be high than low, for while more difficult to heat in winter the rooms are cooler in summer, and the supply of air at all seasons is more nearly adequate. The **amount of room** in a house must necessarily be governed by the family income rather than by the number in the family.

The practice of utilizing porches for sleeping or dining rooms is an excellent one and cannot fail to produce good results; tents also are a practical inexpensive means of enlarging household space for seven or eight months of the year, or even longer in the milder climates. Porches on the south or east side of the house may be shut in with canvas for the winter months and wire fly netting the rest of the year, and used for sleeping practically the whole year.

Furniture. — Too much stress cannot be laid upon simplicity in furnishing. Elaborate decoration, upholstered furniture, heavy portières, and quantities of bric-a-brac require extraordinary care to keep clean, the kind of care which is beyond the means of the majority of households, and it is in the household of moderate means where there are neither time nor servants to clean them that such elaborate furnishings are a constant menace to the family health.

Woodwork. — The finishing woodwork of a house is frequently full of fancy scrolls, panels, and beveled surfaces, which are almost impossible to keep free from dust; whereas perfectly plain surfaces and edges would not only be more sanitary, but much more pleasing to the eye of any person whose tastes were not of the junk-shop order.

Wall paper. — Dull, dark wall papers and rugs "which do not show the dirt" are depressing; Nature is constantly teaching the need and beauty of bright colors. When wall paper is renewed the old paper should always be removed.

Floors should either be of hard wood with polished surfaces, or painted that they may be easily cleaned. Rugs and carpets should not entirely cover the floors nor should they be nailed down, but left that they may be frequently taken up and out-of-doors for cleaning and airing. Sweeping with a broom is strongly condemned, but it seems a question as to which is more dangerous to health, sweeping with a broom occasionally with all windows and doors wide open, or using a carpet sweeper or other hair brush which leaves much dust in the fabric and which is raised in clouds whenever walked over. In many households it is impossible to have rugs and carpets beaten and aired more than four or five times a year; consequently where there are children rugs and carpets soon become very dusty.

Clothing. — The care of body and bed clothing is one of the most important as well as difficult problems of domestic hygiene; the expense of laundry work or the hard labor required to do it are certainly good excuses for economizing, but such economy is doubtless a far more frequent cause of disease than is realized. In the state of Wisconsin a law was recently enacted which requires that all hotels, boarding houses, and sleeping cars shall supply sheets long enough to fold under and over all sides of the bed at least eighteen inches; this law has been the object of great ridicule from the ignorant, who would have no objection to coming in contact with bed covers and mattresses suffering from long-continued use by others; but to any intelligent person such a law is a long step in a sanitary direction, the only regret being that it could not be enforced in every household, school, and hospital in the land, for clean beds are quite as essential for health as clean food.

The custom of collecting soiled clothing in bags or hampers in bedrooms should be abolished; receptacles for soiled clothing may be kept in the bath room provided it has a window or the family is not too large, but a back gallery, porch, or hall had much better be used than the bedrooms.

Every person in a household should be provided with individual towels and wash cloths quite as much as toothbrushes.

Body linen should be changed at least twice a week, oftener in warm weather.

Children's towels, wash cloths, and handkerchiefs must be abundant.

The testimony of many school teachers is, that most children are poorly supplied with clean handkerchiefs, which no doubt contributes largely to the epidemics of influenza and colds.

In public hospitals an incredible number of boys and men patients are brought in, who are not in the habit of wearing underdrawers, causing a most repulsive and unsanitary condition.

Dish-Towels. — The use of unclean dishcloths and towels should be strongly condemned; dishcloths foul with grease and dirty water are often put away without any cleansing and used over and over, while a household where such a condition prevails is nearly always pervaded with house flies which are attracted by filth, and are a constant source of danger to a whole neighborhood.

Ice boxes, cupboards, and cellars where food is stored should be kept scrupulously clean. House cellars should not be used for storing large quantities of fruit and vegetables in winter. In hot weather all food decomposes rapidly and constant vigilance is needed to avoid the extravagance of destroying large amounts, or using food which is in the process of decay.

Disinfectants. — Too many housekeepers gain a superficial and dangerous smattering of knowledge about disinfectants, and lose sight of the fundamental principle of plain everyday soap-and-water and sunlight disinfection; the writer once saw in the house of a wealthy, educated woman a two-ounce bottle of carbolic acid without a cork, suspended by a string on a nail directly over a slop hopper, and was told it was *to disinfect the hopper;* what the slop hopper really needed was hot soapsuds and a brush vigorously applied.

The general rule for the use of disinfectants in the household should be the same as in the hospital or laboratory; viz. that the quantity used should be equal to or exceed the matter to be disinfected; thus the foul slop hopper would need at least two gallons of boiling hot soapsuds, to which might be added a handful of washing soda, a vigorous scouring with a long-handled sanitary brush, and then if followed by one or two gallons, not ounces, of 5 per cent carbolic acid we might reasonably say it had been disinfected.

Protection from Insects and Vermin.— Since diseases such as malaria, typhoid fever, cholera, and tuberculosis are known to be carried by insects and vermin, a house should be provided with wire-netting screens at every window and door, from early spring until after the first heavy autumn frosts, usually late in October. It is essential to retain the screens late, as house flies seem to take a new lease of life when warm days recur, and while in that condition frequently drop dead in milk, water, or food which is not protected.

Screened doors should be provided with springs, that they may never be left standing open.

Two kinds of so-called fly paper for the destruction of flies is in common use, one which is poisonous and another covered with a thick mucilaginous substance, which entraps the fly.

Poison fly paper is particularly dangerous when there are young children in a household, and also the poisoned insect often finds its way into dishes or food. Cleanliness and screens are the best preventives of house flies.

Sloth and filth are usually accompanied by bedbugs. If these are permitted to multiply and a house becomes infested, it is a labor of weeks and months to get rid of them. Fumigation with sulphur, repeated at intervals of a day or two for a fortnight, is efficacious if followed by thorough house cleaning in every crack and crevice of the rooms and kept up for weeks.

Rats and mice often overrun houses and other buildings, and at times are very difficult to get rid of.

Traps will usually dispose of mice, but rats are very wary of traps, and poison is dangerous to have about, besides the danger of the animals dying in wall spaces or under floors.

Cats seem to be the only solution where rats become very numerous, not one cat but several put into basement, cellar, garret, and outhouses. Some persons regard the cats as great an affliction as the rats, but once the rats are exterminated, one good cat will usually protect a house, while rats are destructive and dangerous, as they run in and out of sewers, drains, privies, barnyards, into every imaginable kind of filth, which may be carried on their feet to all parts of a dwelling.

Cellar and basement windows and doors should be kept screened throughout the entire year as a protection from rats and mice.

The details of hygienic housekeeping are too extended to be cited in a book of this kind, but the statement made by Harrington that "housekeeping is too often spread with an uneven hand" cannot be denied.

The slavery to housekeeping which is the lot of so many women, arises largely from their ignorance of the simplest rules of hygiene and the love of display; this is especially the case with women who necessarily must do all or a greater part of their own housework, and it is small wonder that so many of them suffer in health of body and mind from the struggle.

CHAPTER IX

SCHOOL HYGIENE

Section I

The majority of school children spend from ten to twenty-five hours weekly in the schoolroom, for a period of several months each year, for eight or ten years of their lives; such being the case, the need of hygienic school buildings and for good personal hygiene must be admitted.

School hygiene "concerns the parent, the physician, and the citizen, and its investigations must consider the personal hygiene of the scholar, the conditions of his health, his habits, the amount of work done, the sanitary environment and requirements of the schoolroom and building, the furniture, the ventilation and heating, and the influence of all these upon the individual's state and development."[1]

Site. — It is of no less importance for the school to be built upon well-drained soil than for the habitation; this is necessary not only to insure the walls and basements against dampness and to secure good drainage for sewage, but to provide playgrounds which do not permit standing water.

Structure. — All school buildings should be detached to secure the maximum amount of light and air. Double walls with an air space prevent dampness and secure

[1] *Hygiene and Sanitation*, Egbert.

warmth for any building; stone walls are usually damp, while double brick walls with the air space are perfectly dry.

The height of the first story of the building, as well as the window space, should be greater than for the upper stories, to secure the proper amount of light and ventilation.

The windows should be higher from the floor than in a dwelling, and should extend to the ceiling, with proper shades for excluding the direct rays of the sun when necessary.

Lighting. — The proper lighting of schools is of great importance to every child.

The light should be sufficient and come from the child's left side and back; he should never sit facing the light.

Light falling from the right side throws a shadow of the hand when writing or drawing, while light from the front is a constant source of irritation to the eye, and causes squinting and headaches.

Insufficient light is said to be a frequent cause of myopia (near-sightedness) in children.

Cohen maintains that "a schoolroom cannot have too much light" and recommends that for every square foot of floor space there should be a square foot of window glass.

The best authorities recommend that schoolrooms should be oblong, with windows placed in one of the long sides, and seats running parallel to the short side, the light falling from the left side of the pupil.

Blackboards. — The blackboards should never be placed on the same side of the schoolroom as the windows, as the light in the eyes causes an unnecessary strain;

neither should the blackboards have glazed, shiny surfaces for the same reason.

The distance of the blackboard from the farthest seats should cause an inquiry regarding the sight of pupils who occupy them. Copying from the blackboard requires rapid changes in accommodation (adjustment of the eye to different distances), which is regarded as an important factor in producing defective sight.

Corridors and Cloakrooms. — Corridors should be wide and straight both as an assistance in time of fire or other panic and to aid ventilation.

Stairways should be broad and easy to mount, preferably with a landing midway and ending near the door of exit, stairways being placed at both ends of a building.

Wardrobes in the more modern schools are made with individual lockers to avoid contact of clothing. When the corridors are wide enough such wardrobes are placed in them, but in narrow halls this could not be permitted. The especial objection to the wraps being placed in the basement, as is commonly done, is because of the lack of air and light.

In small country schools where the entrance hall is commonly used for wraps, the nearness to the outside door and abundance of light and good air makes a better arrangement scarcely necessary.

Heating and Ventilation. — In large schools like other large buildings the heating and ventilation must necessarily be considered together, the best method probably being the indirect method, whereby the air for ventilation is heated to the required temperature and propelled by fans into the rooms. By this method the air may be filtered and the temperature automatically controlled by a thermostat.

The heating of country schools by stoves in cold climates is as unsatisfactory a method as can possibly be imagined. The floors are always cold and country children suffer cruelly from chilblains and colds; while the upper part of the room is too warm, the outer rows of seats are in an icy atmosphere, and the whole room suffers from bad air.

Sewage, Water-closets, Wash-rooms. — The plumbing of a school building like that of a house should be of the best character, with no hidden pipes and joints, well trapped and an abundant water supply for flushing.

Water-closets and wash-rooms should have air and light in abundance and be built with tile or concrete floors and walls. In the primary rooms the seats of water-closets should be low to suit the child, likewise the washbowls, the latter being supplied with soap and an abundance of small towels. The cost to the community of supplying clean towels for the wash-rooms is a trifle in comparison to the expense of epidemics.

The filth and foul air of the toilet rooms of many schools in decent communities is unspeakable, and aside from the danger of contagion from washbowls, dirty towels, and closet seats, the moral effect is quite as bad.

If every mother would see these rooms where her children attend school, there would certainly be a sweeping reformation. The oversight of such factors belongs particularly to women, and when they are denied a voice in school management, they have it in their power to give publicity to such shameful conditions, and may be pardoned for making themselves extremely disagreeable to the school managers.

Seats and Desks. — Improperly constructed seats and desks by compelling a child to assume a cramped or strained position produce curvature of the spine.

Schoolrooms should not be provided with fixed seats and desks of uniform size according to the grade. In this respect the country schoolroom has the advantage over many town and city schools, as the seats are usually of three or four sizes and children are placed according to their size and not their grade.

Lincoln makes the following suggestions regarding seats and desks: —

"1. The chair is often too high for young scholars. The most convenient plan may be to provide footstools. 2. The seat from back to front ought to be long enough to support the whole thigh. A more or less spoon-shaped hollow in the seat is commonly thought desirable. The curve of many settees is such as to produce pain at the point where the tuberosities of the ischium rest on the wood; the support is there not wide enough. 3. Seats must have backs. The straight, upright back reaching to the shoulders is bad; a straight back, slightly tilted, is not bad. American seats are commonly curved, with curved backs. 4. The edge of the desk should come up to or overlap the edge of the seat. The recognition of this fact is a recent discovery. 5. Most of our best desks are too high relatively to the seat, doubtless to prevent the pupil from stooping. Something is gained in convenience of reading by this plan, but it interferes with correct positions in writing. The elbows, hanging freely, should be only just below the level of the lid. For near-sighted children the higher desk may be a necessity in writing; if the desk is made low, a portable writing stand may be placed on top of it when necessary."

Drinking-water. — The dangers from drinking-water are twofold: from an impure water, and from drinking-cups. Except in the case of very small children all school children should early be taught the dangers of a common drinking-cup. The custom of providing each child with his own cup is right theoretically, but inquiry reveals the fact that many cups go unwashed for the whole school year and may easily carry typhoid fever, tuberculosis, and diphtheria germs.

Common Defects. — Lack of cleanliness is the most glaring and universal defect of schools, the country school being quite as bad as the school in the city.

Dust covers floors, walls, and furnishings, while water-closets and basins are unclean, and the atmosphere is tainted with the emanations from unwashed bodies, soiled clothing, defective plumbing, and coal gas.

The schoolroom floors in most buildings are scrubbed *once a year*, and were it not for the vacation interim, it is doubtful if many would survive in buildings where overcrowding and deficient light and air are present.

In the older public school buildings of several large cities, many have only two or three rooms which have sunlight, while toilet rooms and cloak rooms are in the basements without a ray of daylight, and the entire buildings tainted with the foul air arising from them.

If it were possible to build schools with the same sanitary precautions that enter into modern hospitals, much disease might be prevented.

Concrete floors, and stairs with rounded angles, perfectly plain woodwork and furniture, sunlight in every room, and good plumbing would make a vast difference in the health record of schools. With concrete floors provided with drains the floors might be washed or flooded daily and do away with the suffocating dust arising from unwashed wood floors, and chalk, which cannot fail to be a carrier of infectious materials.

In country schools lack of cleanliness is less harmful on account of the abundance of pure air and sunshine, but the cold floors, improper lighting, and absence of all toilet conveniences make them extremely uncomfortable and often unsanitary.

Luncheons. — The subject of luncheons for school children is an important one to the city and country pupil; in small cities and towns the majority of children go home for their noon meal, which is a great advantage.

The luncheons of country children from comfortable homes are better, from a hygienic standpoint, than the almost universal custom of large cities, where children buy what suits their fancy from any convenient bakery or lunch room.

For fifteen years the writer daily passed a lunch room near a large public school in a well-to-do neighborhood, and feels safe in saying that fully two thirds of these children, between twelve and eighteen years of age, made their noon meal upon a cup of coffee and a piece of pie or cake, with ice cream as a luxury.

The unappetizing medley of food jumbled into a lunch box which commonly passes for the school lunch, is so altogether unpleasant that the child cannot be blamed for particularly objecting to them; but there is no necessity for a lunch box being monotonous or unappetizing.

An infinite variety of sandwiches made of bread and meat, or eggs, or cheese, or jam are easily prepared, and when neatly put together and each sandwich rolled in the paraffin paper which may be bought in any grocery store, they are not unsightly nor flavored with the other articles of food; simple cakes or cookies, fruit, and a few pieces of pure candy make a good variety, and an occasional turnover or individual pie is always the treat.

A common mistake is in providing too much. The prevailing habit of overeating doubtless originates in the almost universal practice of giving small children something to eat to keep them quiet. Children, like adults, who eat too much are heavy and inert, with little relish for study.

The diseases and disorders common to school children arise very largely from contact, — especially the infectious diseases, scarlet fever, diphtheria, measles, chicken pox, and mumps, — the common cloak room being the important place of contact, as coats and wraps hang together for several hours.

Defective sight may be caused by improper lighting or badly constructed seats and desks. Copying from the blackboard should not be a routine practice, as before mentioned; the rapidity of changes in accommodation produces eye strain and its consequent headaches.

Disordered digestion is very common with school children, caused by nervousness when the child strives to make grades or is worried over examinations, or from lack of exercise, or improper food.

An investigation among the tenement children of one large city revealed the fact that many puny children came to school without any breakfast, and some with no lunch, their only meal being at night when the father and mother returned from work; these children nearly all suffered from indigestion.

Headaches arise from indigestion and bad air as well as lack of exercise and eye strain.

Curvature of the spine is said to be caused by wrong positions in seats or at desks, but with healthy, vigorous children it seldom occurs, the impaired vitality of underfed and overworked children being a greater factor than improper seats and desks.

Underfeeding is not confined to the tenement children. The child subsisting upon coffee and bakery pie stands quite as good a chance of contracting curvature of the spine as the child with no breakfast.

The nervous strain of overwork in school is more noticeable in girls than boys. Girls after the age of twelve need special supervision over their diet, exercise, clothing, hours of sleep, and recreation. Girls usually are required to spend more time out of school upon music or other accomplishments, and they suffer from the restriction of their recreations. Again, with the poorer classes, many young girls are required to do several hours of laborious housework morning and evening, while boys who are required to work usually find employment out-of-doors, which is far more wholesome.

Children suffering with chorea and epilepsy should not attend school with other children; the excitement and school routine and conditions aggravate both maladies and the effect of their evident disorders upon other nervous children is serious.

Growths or obstructions in the nose or throat are very common.

R. H. Johnston "regards the real nature of mental and nervous troubles in these cases as toxic from a deficiency of oxygen in the inspired air. The list of symptoms produced includes mental dullness, restlessness, night terrors, nocturnal incontinence, headaches, stuttering, and various other defects of speech, choreic movements of face, etc. Mention is made of reflex nervous cough, irritability of disposition, etc."[1]

The tendency of parents to put the onus of impaired health upon the strain of overwork in school is often unjust; a child who is well fed, clothed, and sheltered in clean surroundings with sufficient sleep and exercise very seldom suffers from too much study.

Section II

Medical Inspection of Schools. — The objects of the medical inspection of schools are the prompt exclusion of all children who are suffering from contagious diseases, the detection of physical defects which hinder the child's development, such as defective hearing or sight, or to note delayed development from other causes such as lack of food or clothing, or unhygienic home surroundings.

It is said that in Europe the medical inspection of schools has been carried much farther than in this country and begins with the inspection of all plans for new school buildings, which must conform to a certain sanitary standard.

The Medical Inspectors examine the air of classrooms and the drinking-water; they superintend the seating of the children, besides the regular medical inspection of all pupils.

[1] Medical Record.

In a few of our large cities, school nurses have been appointed as assistants to the Medical Inspectors, who are able to attend to minor surgical dressings, treatment of eyes, ears, and throats, and to look after the personal hygiene of the children in many ways which only women and nurses can do.

The medical inspection of schools is one of the most important factors in the prevention of disease in all large cities.

The following extract from the report of the Department of Health of Chicago for the six months ending July 6, 1907, tells very forcibly of the need of such inspection.

Report of the Chief Medical Inspector. — During the first six months of the year there were reported to the Department of Health 6991 cases of scarlet fever, 3011 cases of diphtheria, 2812 cases of measles, 137 of whooping cough, 118 of typhoid fever, 106 of tuberculosis, and 338 cases of all other contagious diseases — a total of 13,513 cases brought to the notice of the Department.

The beginning of the year showed scarlet fever, diphtheria, and measles epidemic and on the increase. The threatening indications of such a condition were pointed out in the Department Bulletin as early as the first of October, 1906. The necessity for medical school inspection was urged in almost every issue of the Bulletin after that date, but those who could furnish the means and whose duty it was to provide the inspectors for staying epidemics paid no heed to the warning. "Show us the epidemic before we will spend precious money," seemed to be the spirit.

The epidemic was obvious enough to be seen outside of the Bulletin by January 1, and by January 20 School Medical Inspectors had been provided and the work of stopping the epidemic of disease, which was now under full headway, was begun. The inspectors went at the task with confidence and ability, and within two months scarlet fever and diphtheria were completely under control.

In January, 3058 cases of scarlet fever were reported to the Department; in June but 315 were reported. In January, 923 cases of diphtheria were reported; in June the number dropped to 259.

From January 20 to June 1 the School Medical Inspectors examined 123,460 pupils and excluded from school on account of contagious diseases 18,826 pupils, or nearly 15 (14.6) out of every hundred examined. (See appended table: Medical Inspection of Schools.) It is safe to say that many of the public schools would have been closed if the Medical Inspectors had not been provided. With the School Inspectors working, it did not become necessary to close any school, except for a single day in a few instances, to perform disinfection.

One of the benefits to be derived from school medical inspection is to do away permanently with the necessity for closing schools on account of the presence of contagious diseases. The saving of money, preventing needless suffering, and saving life are some other benefits of this service.

The work of the Inspectors demonstrated that even in the face of an epidemic of scarlet fever and diphtheria under full headway, the spread of the disease can be checked if Medical Inspectors are provided. If the recommendations of the Health Department in regard to the number of Inspectors needed are followed, a repetition of last winter's epidemic with its attendant suffering, loss of life, and ineffectual expenditure of money can be avoided.

At the beginning of the year, with smallpox in various places in the country contiguous to Chicago we were menaced with that disease. Smallpox has been repeatedly imported into the city but has not gained a foothold. Neither can this disease make much headway in Chicago so long as the present enforcement of vaccination is kept up, though there are enough unvaccinated persons in the city to make it necessary to maintain a hospital, at considerable expense to the taxpayers. This expense is just so much tribute paid to the ignorant and stubborn who object to vaccination.

Sixty-nine cases of smallpox were sent to the Isolation Hospital from January 1 to July 1. Of this number sixty-one never had been vaccinated; eight had old, imperfect, and doubtful scars made in childhood. Not one of these eight had been revaccinated or recently vaccinated. The scars were from twenty to forty years old, and appeared to be scars from too deep scarification and aggravated by infection, without effective vaccination. Had these persons been vaccinated and revaccinated, not one of them would have contracted smallpox, and the city would have been spared the expense of feeding and caring for them.

It is gratifying to know that the intelligence of Chicago is actively aiding the Department in educating the people in the matter of vaccination. The large mercantile houses, manufacturers, railroads, the clergy, the School Board and school principals, the newspapers and medical profession are potent factors in safeguarding Chicago against an epidemic of smallpox.

Vaccination must be kept up without abatement if we are to keep free from smallpox. Neglect vaccination, even for one year, and the hospital will be filled with smallpox if it is once introduced into the city.

At the end of the first six months of the year the condition as to contagious disease is gratifying, and there is good reason to think we will be able to keep epidemic diseases down to the low mark shown in the present daily reports.

School medical inspection will be resumed with the opening of the schools in September.

MEDICAL INSPECTION OF SCHOOLS (CHICAGO)

Monthly Summary of Examinations and Exclusions for the First Six Months of 1907

Causes of Exclusions	[1] Jan.	Feb.	March	April	May	June	Totals
Chicken pox	39	158	122	111	69	117	616
Diphtheria	124	117	63	37	24	23	388
Impetigo contagiosa	18	89	144	98	47	25	421
Measles	94	387	528	586	772	717	3,084
Mumps	110	634	554	302	147	123	1,870
Pediculosis	22	217	389	176	97	70	971
Purulent sore eyes	10	48	77	59	16	7	217
Scabies	21	104	88	123	42	35	413
Scarlet fever	254	348	316	152	91	28	1,189
Tonsilitis	357	1,449	1,094	484	150	98	3,632
Tuberculosis	.....	....	....	1	....	....	1
Whooping cough	57	159	104	109	65	36	530
Other affections [2]	188	1,626	2,015	1,213	263	189	5,494
Total Exclusions	1,294	5,336	5,494	3,451	1,783	1,468	18,826
Total Examinations	8,458	36,621	34,326	20,261	15,717	13,077	128,460
Cultures Made for Bacterial Examination	129	336	210	128	54	30	887
Vaccinations Performed	....	....	10	22	161	211	404

[1] Inspection began January 21, 1907.

[2] Chiefly ringworm and "suspicious cough."

Following are the rules for Medical Inspectors and School Medical Inspectors, issued by the Department of Health of Chicago: —

Medical Inspectors should familiarize themselves with the City Health Ordinances. (Copies can be had by applying to the Secretary.)

Beginning at 9 o'clock Medical Inspectors will call daily at the schools assigned them, and request principals to have all pupils in readiness for examination who have been absent from school for four consecutive days. The principal will also refer to the Inspector any pupils in school who are suspected to be suffering from infectious or contagious diseases.

The examinations will be made at the school.

The principal of school should have all children to be examined sent to a room by themselves, where the other pupils will not come in contact with them and where the School Inspector can examine them.

Inspection is to be made in reference to communicable diseases and the vaccinal status of pupils only.

Examinations are to be made for the following diseases: scarlet fever, diphtheria, measles, rötheln, smallpox, chicken pox, tonsilitis, pediculosis, ringworm, impetigo contagiosa, or other transmissible diseases of the skin, scalp, and eye. Tuberculosis, when thought to be far enough advanced to be a menace to the public health, must be reported to the Chief Medical Inspector before excluding the pupil from school.

Scarlet fever cases must not be allowed to return to school until all desquamation is completed, and there is an entire absence of discharge from ears, nose, throat, or suppurating glands and the child and premises are disinfected. This requires at least six weeks — severe cases eight weeks or longer.

Diphtheria cases must be excluded until two throat cultures made upon two consecutive days show absence of the Klebs-Loeffler bacilli. Those exposed to diphtheria should be excluded one week from last exposure.

Measles cases are very infectious in the early stages, and must be excluded at least three weeks and longer if there is present bronchitis, inflammation of the throat, nose, or abscess of the ear. Those exposed to measles should be excluded two weeks from date of last exposure.

Whooping cough cases should be excluded until after the spasmodic stage of cough — usually about eight weeks. Whooping cough is very infectious in the early stages of the disease. Those exposed to whooping cough should be excluded two weeks from date of last exposure.

Mumps. — Exclude ten days after all swelling has subsided. Those exposed to mumps should be excluded three weeks from date of last exposure.

Chicken Pox. — Exclude until scabs are all off and skin smooth — two or three weeks, according to the severity of the attack.

Rötheln, German Measles. — Exclude from school two weeks. Those exposed to rötheln must be excluded from school three weeks from date of last exposure.

Cases of tonsilitis must be excluded on the clinical evidence alone, and throat cultures made for further diagnosis.

Cases presenting suspicious throats, but not definite evidence of disease clinically, must have throat cultures made, allowed to return to their classes until the cultures have been examined, and only excluded in case the bacteriologic examination shows exclusion to be necessary.

In making inspections care must be used to disturb the child as little as possible, and throat cultures are to be made only when good reason therefor exists.

In making throat examinations, the wooden tongue depressors supplied must be used, to the exclusion of all other tongue depressors. Each tongue depressor must be used only once and then burned. Aseptic methods must be employed in all examinations.

If a child is excluded, brief but sufficient reason therefor must be written on the exclusion card.

Inspectors are forbidden to make any suggestions as to the treatment or management of pupils who are sick. *This is imperative.*

Children recovering from measles, whooping cough, mumps, chicken pox, scarlet fever, diphtheria, and smallpox must not reënter school without a permit from the Department of Health.

When a pupil is taken sick with an infectious disease in a schoolroom, the pupils in the room must be dismissed and the room disinfected.

If smallpox is found in the eruptive stage, the child can be taken to his home if near and there isolated until the ambulance arrives, or isolated in the room where found. In doing this no one should be allowed to come near the infected child.

Children properly vaccinated who have been exposed to smallpox need not be excluded from school. Those exposed and not vaccinated must be excluded twenty days.

Pupils living in apartment buildings, where an infectious disease exists, should be excluded from school by the principal. A visit to the building by the Inspector will determine who can return to school with safety. It depends upon the construction of the building and the habits of the inmates whether it is safe to let any from the building continue in school. The Inspector must be the judge. Usually if families use the same entrance there is some risk, and yet a case can be so well isolated and cared for that all others in the building are safe. A visit to the building is necessary to determine this.

All cases of infectious diseases coming under the observation of the Inspector which are not properly safeguarded should command his attention.

Give proper instructions to the family, leave the Department circular applicable to the case, and take any other measures necessary to protect the public health. Investigate all suspected cases of infectious diseases in your territory and take proper measures for safeguarding against the spread of infection. Make daily reports to the Chief Medical Inspector upon blanks provided for the purpose of each case inspected or investigated. Beginning October 15, School Medical Inspectors will vaccinate free of charge any child or pupil who may apply to him for vaccination, and must issue a certificate of vaccination to those entitled to the same. The Inspectors will vaccinate no child without the consent of parent or guardian.

The Department prefers that the family physician should perform vaccination; but if the parent or guardian of a child wishes it done by the Department the child may be taken or sent to the School Medical Inspector or Public Vaccinator, whose duty it then is to vaccinate such child and furnish a certificate without charge.

Examine every school pupil's arm to determine the vaccinal status. Any discovered not complying with the vaccination ordinance must be excluded from school by the principal. Read the ordinance carefully and be governed by it in the matter of vaccination. Inspectors must make monthly reports upon blanks furnished for that purpose, giving the number of tubes of vaccine received during the month, the number of primary vaccinations performed, the number of revaccinations performed, the number of certificates issued to those previously vaccinated within seven years and entitled to a certificate without a revaccination, the number of attempted vaccinations on primary subject resulting in failure to take, and the number of attempts at vaccination in previously vaccinated subject resulting in failure to take.

Inspectors must carry with them a supply of the Department circulars to hand out for instruction in cases of infectious diseases. The circulars are: Information for the family in case of contagious diseases. Circulars on prevention of consumption. The Vaccination Creed. Special circulars on each of the infectious diseases and warning slips to distribute and paste up for the public to read. Spatulas for tongue depressors. Culture mediums and outfits for Widal test.

MEDICAL INSPECTION OF SCHOOLS

RECORD OF EXCLUSION

DATE________________19__

SCHOOL________________

PUPIL________________

ADDRESS________________

CAUSE OF EXCLUSION:

____

____

READMITTED________________19__

CITY OF CHICAGO, DEPARTMENT OF HEALTH

MEDICAL INSPECTION OF SCHOOLS

________________19__

SCHOOL________________

NAME OF PUPIL________________

HOME ADDRESS________________WARD________

THE ABOVE-NAMED PUPIL IS HEREBY ORDERED TO DISCONTINUE ATTENDANCE AT SCHOOL TEMPORARILY FOR THE FOLLOWING REASONS:

____

____

________________M.D.

(HAND TO PUPIL EXCLUDED) MEDICAL INSPECTOR

MEDICAL INSPECTION OF SCHOOLS

RECORD OF EXCLUSION

DATE________________19__

SCHOOL________________

PUPIL________________

ADDRESS________________

CAUSE OF EXCLUSION:

____

____

READMITTED________________19__

CITY OF CHICAGO, DEPARTMENT OF HEALTH

MEDICAL INSPECTION OF SCHOOLS

________________19__

SCHOOL________________

NAME OF PUPIL________________

HOME ADDRESS________________WARD________

THE ABOVE-NAMED PUPIL IS HEREBY ORDERED TO DISCONTINUE ATTENDANCE AT SCHOOL TEMPORARILY FOR THE FOLLOWING REASONS:

____

____

Mail this Card to Chief Medical Inspector same day pupil is excluded.

________________M.D.

MEDICAL INSPECTOR

DEPARTMENT OF HEALTH, CITY OF CHICAGO

MEDICAL INSPECTION OF SCHOOLS

CHICAGO, ________________ 19__

SCHOOL ____

NAME OF PUPIL ____

ADDRESS ____

is relieved from further restrictions and has permission to reënter school.

____

MEDICAL INSPECTOR.

☞ This certificate to be given to pupil to present to School Principal.

Warnung! Avviso! **WARNING!** Przestroga! וואָרנונג.

CHICAGO HEALTH DEPARTMENT

There is — DIPHTHERIA; SCARLET FEVER — In this Neighborhood

Parents should locate the infected family and **keep their children away from it**, and especially from any of the children of the family, and should not visit it themselves.

During the danger period parents should also carefully watch their children for any suspicious symptoms — such as SORE THROAT, FEVERISHNESS, HEADACHE, SUDDEN VOMITING, RASH, CROUPY COUGH, CLOGGING OF THE NOSTRILS, SWELLINGS ABOUT THE NECK. Some of these symptoms indicate Diphtheria; others indicate Scarlet Fever or Scarlatina.

When any of them appear in a child living in an infected neighborhood, the child should be cared for AT ONCE.

The HEALTH DEPARTMENT — Room 0, City Hall, Telephone 00 — should also be notified so that it may give any needed assistance.

____

CHIEF MEDICAL INSPECTOR.

ADDITIONAL DUTIES OF SCHOOL MEDICAL INSPECTORS

The city has been divided into eleven districts. A Medical Inspector, a Sanitary Inspector, and a Milk Inspector are placed in each of these districts. Each of these districts is subdivided into nine districts with a School Medical Inspector in each of these minor districts. The nine School Medical Inspectors will be under the direction of the Medical Inspector. Each morning before 9 o'clock the location of the infectious diseases reported to the Department will be telephoned to the School Inspector in the district from which the case is reported. The Medical Inspector will have the same information from the nine districts. The School Inspector will visit all cases reported from his district, see that proper isolation is established, determine who from contiguous flats or houses can safely remain in school, and see that the warning card is on the door or where it will best serve the purpose of warning any who may approach the infected premises. See also that a warning card is posted where the milkman who delivers milk will see it, leave the Department circulars giving information in cases of contagious diseases and distribute and post the small warning leaflet in the near-by neighborhood and mail a notification card to the principal of school.

The Inspector notified will take smears in cases of diphtheria to determine when the case is ready for termination. When the District Medical Inspector has more antitoxin work than he can attend to, the School Medical Inspector will aid in this work. When the School Inspector is in doubt about a diagnosis he will call upon the District Medical Inspector to help in making a diagnosis. The School Inspector is to have charge of all infectious diseases in his restricted territory and will be held responsible for the work in the territory assigned him. The Medical Inspector will be held responsible for the work of the nine School Inspectors in his district. To assist the Medical Inspectors three diagnosticians have been designated — one on each of the three sides of the city. In making inspections and investigations you will observe the following instructions:—

Inspectors must keep in close touch with the Department of Health so they may be reached without delay when wanted.

Contagious diseases and suspected contagious diseases reported to the Department of Health are assigned to the Medical Inspectors and School Medical Inspectors either for *inspection* or *investigation*.

Cases for *inspection* are those reported by physicians. In these cases see that the family receives a copy of the Department "Circular of Information upon the Management of Contagious Diseases," and give them such further advice concerning the best methods to pursue for preventing the spread of contagion as you deem necessary.

Especially instruct the family in regard to the *length of time cases should be isolated* and impress upon them the necessity of a thorough disinfection after the case has terminated.

Tell them to have their doctor notify the Department when the case is free from giving off contagion and the house is ready for disinfection — *and not before*. Disinfectors are frequently sent to families only to find that the patient is still in the contagious stage, especially in scarlet fever. This means loss of time to the disinfecting force.

Notify by postal card provided the principal of every school in the vicinity, both public and parochial, during vacation as well as while school is in session, whom to exclude from school and take such other measures in the case as may be needed to protect the public health. You are the judge of whom it is safe to permit to attend school from flats or houses contiguous to infected premises.

If you find the family disregarding the doctor's instructions concerning isolation, disinfection of excretions, etc., supplement his instructions and through your own efforts see that the family observes proper precautions.

If the case is in any way connected with a shop or store, *at once* make the case safe to the public by one of the following plans: —

1. When it is best to do so, the Department of Health will remove the patient to a hospital. No one can move a person sick with an infectious disease without the consent of the Commissioner of Health.

2. If the patient remains, the room must be shut off from the store by sealing cracks of doors and keyholes with paper and paste. All communication between the sick room and the store must be stopped.

3. If neither of the above plans is followed the store must be closed, the door locked, and the public excluded.

Cases for *investigation* are supposed cases, such as are reported to the Department through other sources than physicians. These you will visit and ascertain the nature of the disease, and if found to be scarlet fever, diphtheria, whooping cough, or measles, see that the attending physician, if there be one, reports the case to the Department, or report it yourself by card, as you do in a case where there is no physician. Put up a warning card and take the same precautionary measures as in cases for *inspection.*

Send notices to principals of schools of any and all contagious diseases encountered while inspecting and investigating cases.

Make *daily reports* to the Department of all cases inspected or investigated.

Endeavor to learn the source of infection in every case: milk supply, fruit, infected clothing, or persons, etc., and communicate to the Department any information of interest which you may learn concerning this subject.

When notified of a suspected case of smallpox, the Inspector must go to the case forthwith. An hour's delay may result in many needless exposures.

The following suggestions as to conduct in the presence of smallpox should be observed so far as the circumstances of the case will permit with safety. The Inspector must supply any deficiency in these instructions which the case may demand for the safety of the public.

When entering a house where there is a suspected case of contagious or infectious disease, do not remove your hat or overcoat; keep the overcoat buttoned.

Do not shake hands with any one in the house. Do not sit down or touch anything in the house and especially avoid touching the patient or bed clothing. To expose the patient for examination call upon the patient or some one present to remove the clothing for you.

When leaving the house have some one open the door, so as to avoid touching any infected doorknob.

Except to vaccinate the inmates of the house, it is not necessary to touch anything about the premises except the floor with the soles of your shoes.

If these precautions are observed there is no danger of carrying the disease to others.

When it is determined the case is one of smallpox, fill out the history blank provided for the purpose (Form 2), telephone the information to the Department, and promptly mail the filled blank to the Chief Medical Inspector.

Telephone instructions as to the disposal of the case, whether an ambulance or a carriage is needed, the amount of disinfecting to be done, and the number of vaccinators needed.

In filling out the blank secure a list of all who have in any way been exposed to the contagion since the first day of the sickness, learn if letters or laundry have been sent out from the house and where and to whom sent. Give the vaccinal status of those exposed so far as you can.

It is the duty of the Inspector to vaccinate or see that some other medical inspector vaccinates all who are known to be exposed to the infection. Do not leave or allow this duty to be done by the family physician. It is the duty also of the Inspector to secure the consent of the patient or family for the removal of the patient to the Isolation Hospital. Do not leave this duty to the ambulance driver.

Until the ambulance comes the case must be made safe. If it is necessary to police the house to secure safety, do so. After securing the prompt vaccination of all exposed it is the Inspector's duty to see the exposed every other day for fifteen or twenty days. If the first vaccination does not take, repeat until it does take.

If there is doubt about the diagnosis, vaccinate the inmates of the house, make the case safe to others, and see the patient later.

A Medical Inspector must be courteous and should be tactful in all his relations to cases of smallpox, the same as a doctor should be in his private practice. He should be a complete master of the situation, able to dispose of complications and duties as they arise, in a proper manner. It should not be burdensome to do so, for the reward is always present, the consciousness that it is life-saving work.

Use discretion and secure compliance with the ordinance without force.

This can almost always be done, but if necessary the police power can be used to enforce compliance with the law.

"The medical department of the Philadelphia High School for girls was established in 1893. Prior to this time the attendance of any physician was depended upon in an emergency, so that much time was lost, and the uncertainty of obtaining assistance was great. In 1893 the services of a graduate of the Woman's Medical College were secured. The duties of the head of the medical department constantly increased from one hour a day to continual attendance from the opening of the school at 9 A.M. until the close of the session at 2 P.M.

" At the beginning of each school year in September all vaccination certificates and scars are examined; in doubtful cases a certified revaccination is required. Teachers at the beginning of each morning session inquire whether any student is suffering from sore throat, headache, or other ailment; all such are at once referred to the medical room. A daily record of students sent to the medical room is carefully kept. Any student with a temperature of 100° F. is detained in the 'sick room' until the temperature becomes normal. If a rise takes place, the student is sent home in a carriage. On stormy days students who have wet shoes, stockings, or skirts are required to report at the medical room, where dry garments are provided. All wet clothing is dried in a room prepared for the purpose, and is made ready for the student at recess in the medical room at noon. Every part of the entire building is thoroughly cleansed daily. The balustrades and desks throughout are carefully cleansed each day with antiseptic solution. The drinking-water is filtered, then sterilized, and the ice is made from sterile water. The sanitary condition of the toilet rooms is excellent. There are now individual compartments, where formerly there were congregate rooms.

"The medical department is ideal in location, having a south and east exposure, with a good supply of sunlight, while its situation insures all the quiet necessary. This room is supplied with all that is required for any emergency that is likely to occur. There is an ample supply of filtered water and appliances for obtaining boiling water. The department is provided with four wicker couches with cushions covered with linen slips; the latter are frequently removed and laundered while the cushions themselves are detached, shaken, and placed in the sunlight. A part of the engine-room space is used for drying clothing." [1]

Boarding schools should have not only suitable sick rooms, but arrangements for complete isolation in case of infectious diseases.

It is not sufficient to put a patient into one room with a nurse and exclude visitors, and call it isolation; but the room must be apart from other rooms, preferably at the top of the building or in a separate building, and must be provided with its own bath room and cooking facilities and also some means of allowing the nurse to come and go out of the building without contact with other pupils.

The so-called isolation rooms of many schools and institutions are so lacking in every detail of isolation, that they are a disgrace to intelligent communities. There can be no halfway measures regarding isolation; either the arrangements isolate or *they do not.*

The following circular of Information for the Family in the case of Contagious Diseases, issued by the Department of Health of Chicago, while not strictly within the medical inspection of schools is used very largely in connection with the infectious cases arising in the schools, and is an excellent example of the efforts made by such bodies in all cities, to help and enlighten those who need it, and to control the spread of contagion, and is of still further use for nurses who are preparing themselves for visiting nursing among the poor in tenements.

Many of the milder forms of infectious diseases occur where a physician can be employed only for an occasional visit.

[1] *Principles of Hygiene,* Bergey.

The Department of Health has deemed it advisable to issue the following information to the families of those so afflicted.

The information here furnished is not to supplant, but to supplement the advice of the medical attendant if there be one.

MANAGEMENT OF CONTAGION

In any case of infectious disease the patient should be placed, if possible, in a room apart from the rooms occupied by other members of the family. All doors opening into the patient's room should be covered with a sheet kept wet with a disinfecting solution. A bed sheet, or one made of cheap cotton cloth, should be fastened to the top of the door frame and down the hinge side of the frame, leaving the edge on the lock side free to be turned back when passing through the door. The sheet must be long enough to allow two or three inches to lie on the floor.

No article of furniture — carpets, rugs, curtains, ornaments, books, etc. — except the things actually necessary for the care and comfort of the patient should be left in the sick room. Exclude cats, dogs, and other pets, including birds, from the room, since these are liable to contract and carry some of the contagious diseases.

Isolation to be Effective must be Complete. — No person except the strictly necessary attendants should be allowed to enter the sick room. These should wear only such clothing as can be boiled in water. The hands should be rinsed in a disinfecting fluid immediately after every attention to the patient. The attendant should avoid inhaling the patient's breath; and in case of diphtheria or croup, if the patient coughs in the attendant's face she should at once wipe the face with a cloth wet with a disinfecting solution.

The floor of the sick room must not be dry swept. Instead of sweeping, go over the floor with a mop or cloth wrung out of the disinfectant. And instead of dusting, all accessible surfaces — as of doors, door-knobs, wainscots, window frames and ledges, tables, chairs, the exposed parts of the bed frame — should be wiped with a cloth dampened with the disinfectant.

All dishes and table utensils used in the sick room must be placed in boiling water or rinsed in a disinfecting fluid before being taken from the room.

Flowers brought to the sick should not be thrown out, but placed in the disinfecting fluid and then burned.

A sufficient quantity of a good disinfectant should be kept in the sick room in a wooden pail, slop jar, or other vessel — not metal if the corrosive sublimate solution is used — and into this all towels, napkins, handkerchiefs, pillow slips, sheets, etc., and all articles of clothing used in the room must be dipped and wrung out before removal. They should be taken to the laundry while still wet and there be rinsed in clean water and then before drying have them thoroughly boiled. If the carbolic acid solution is used the rinsing is unnecessary, as this disinfectant does not injure the boiler.

All discharges from the mouth and nose in diphtheria, scarlet fever, membranous croup, measles, or whooping cough, should be received upon pieces of old soft cotton or linen, worn handkerchiefs, etc., and burned at once. Do not allow cuspidor or other spit vessel to be used in the sick room, and especially do not allow the patient to spit on the floor. If this should accidentally happen, wash the place immediately with the strong disinfectant.

The night vessel should be kept one third full of the strong fluid, to be emptied not sooner than half an hour after each use, and then immediately resupplied with fresh fluid. All discharges should be disinfected in this way before being emptied into water-closets or otherwise disposed of. This is especially important in typhoid fever.

These precautionary measures should be continued after the recovery or death of the patient until the house is disinfected.

A good disinfecting fluid is readily made by dissolving a corrosive sublimate tablet in warm water. The tablets should be procured only on the physician's prescription and used strictly as he directs. The fluid is poisonous if swallowed.

A 15-grain tablet, containing between 7 and 8 grains of corrosive sublimate, will make a pint of strong disinfecting fluid, useful for most purposes. Half this strength — one tablet to a quart of water — is sufficient for wetting the door sheets and for washing the hands.

A five per cent solution of carbolic acid is a reliable disinfectant, and can be kept in any vessel, as it does not materially injure metals.

One and one half ounces of strong carbolic acid in a quart of water makes about the desired strength for disinfecting purposes. Carbolic acid is poisonous if swallowed, and should be procured and used with the same care exercised in using corrosive sublimate.

DURATION OF CONTAGION

It is not possible to fix the time when a person afflicted with an infectious disease ceases to be dangerous to the public health, as the time may differ in each case, but the Department desires to give information that will be a practical guide in all cases.

The information here given is in accordance with the best authorities available.

Diphtheria. — The period of isolation should continue so long as a microscopical examination shows the presence of diphtheria germs. If no microscope is used, isolate in mild cases at least ten days after all membrane has disappeared from the throat and nose. In severe cases wait three weeks after all membrane has disappeared from the throat and nose.

If there remains any discharge from the throat, nose, ears, eyes, or if there is evidence of inflammation of the kidneys, the time of isolation should be extended till these local disorders have disappeared.

Scarlet Fever or Scarlatina. — These two terms refer to the same disease. Complete isolation should be enforced till all desquamation, or scaling off, of the skin is completed and there is entire absence of discharge from ears, nose, throat, suppurating glands, or inflammation of kidneys. The time required for scaling will vary from four to eight weeks. Mild cases, in which scaling is not noticeable, with absence of ear, nose, throat, kidney, and glandular complications, should be isolated not less than six weeks. In severe cases not less than eight weeks should be the period of enforced isolation, and if ear, nose, throat, glands, or kidneys are diseased prolong the time of isolation until these are well. The Department will not act upon any request for disinfection in a case of scarlet fever until the above symptoms have disappeared. Do not request it.

Measles. — A fatal disease among young children. The average death rate among children under two years of age is about one death in five cases. Some epidemics show a death rate of 30, 35, and even 50 per cent. Isolation for four weeks should be the rule and longer if there is present bronchitis, inflammation of throat, nose, or abscess of ear.

Whooping Cough. — Also very destructive in child life. The average death rate is about twenty-five per cent in children under one year of age. In some epidemics the death rate has been 50 per cent. Death from this disease is rare after a child is four years old.

The aim should be to protect especially children under four years of age from contagion of measles and whooping cough. The period of isolation for whooping cough should be till after the spasmodic stage of cough, which is usually eight weeks.

Mumps should be isolated three weeks, or ten days after all swelling has subsided.

Chicken Pox. — Isolate till the scabs are all off and the skin smooth.

Smallpox. — The Department of Health takes complete charge of these cases.

If properly vaccinated no one can have smallpox.

DISINFECTION

Do not ask to have the house disinfected till all symptoms of the diseases mentioned under "Duration of Contagion" have disappeared. No matter how well the child may appear, until all evidence of remaining disease is removed it is useless to disinfect, and criminal to let the child mingle with well children.

When the case is ended soak all sheets, pillow slips, towels, and other washable articles in the sick room, in the strong disinfectant and remove them while wet to the laundry, to be boiled at least thirty minutes. Sprinkle thoroughly all surfaces of pillows and of the mattresses with the strong disinfectant and then carry into the open air, to be exposed to sunshine for at least six hours, frequently turning the articles. Mattresses and pillows should be burned or sterilized by heat if soiled by discharges from the patient. Consult the physician on this point.

Wash the floor and all woodwork, first with the strong disinfectant and immediately after with hot water and German green soap—to be had at the drug store. Treat the furniture in the same way. Brush the ceiling and walls thoroughly with the disinfectant and then repaper or calcimine, after two or three days' exposure by open doors and windows. Do not neglect closets, shelves, ledges, cornices, or other surfaces on which dust may settle.

The following is the Department method of formaldehyde disinfection: —

The room to be disinfected is sealed and prepared as usual for sulphur disinfection, by pasting strips of paper over cracks of doors and windows. All its surfaces are exposed as much as possible; closet doors are opened and their contents, together with the contents of drawers, are removed, scattered about, and the drawers left open mattresses are set on end; pillows, bedding, clothing etc., are suspended from lines stretched across the room or spread out on chairs and other objects so as to expose all sides; books are opened and the leaves spread — in short, the room and its contents are so disposed as to secure free access of the gas to all parts as fully as possible.

For every 1000 cu. ft. of space in the room, suspend by one edge an ordinary bed sheet (2 x $2\frac{1}{2}$ yds.) from a line stretched across the middle of the room. Properly sprinkled this will carry without dripping eight (8) ounces of formalin — the 40 per cent solution of formaldehyde gas—which is sufficient to disinfect 1000 cu. ft. of space. As many sheets as necessary are used, hung at equal distances apart. The ordinary rather coarse cotton sheet should be used in order to secure rapid evaporation. The house should remain sealed not less than eight hours.

A rosehead sprinkler used by florists can be used for sprinkling the sheets.

The practice of burning a few sulphur candles in the house does no good and should be abandoned.

Principals of schools should not permit children from an infected house to reënter school without a termination card from the Department of Health.

MANAGEMENT OF FUNERAL

In case of death from contagious disease the body should be placed in a coffin as soon as possible, the coffin immediately sealed and not again opened.

There should be no flowers. The funeral should be held within thirty-six hours after death and should be private.

By a private funeral is meant one that is attended only by members of the household already exposed to the infection and such adults as are necessary to aid the undertaker. All others, especially children, should not be exposed to the contagion. No visitors will be allowed in the infected house.

CHAPTER X

HYGIENE OF OCCUPATION

The best authorities differ in their estimate of the value of statistics of death rates of the various occupations. While not disputing that many occupations cause or are a predisposing factor in causing disease, the wide difference in age, heredity, habits, and surroundings of individual workmen makes such statistics misleading.

Many occupations, such as the army, navy, factories, and railways, are dangerous to life but not necessarily to health.

Tuberculosis is common among dressmakers, tailors, cutlery grinders, and the factory workers of cotton and woolen mills, but the disease germs are not found in the lint nor dust, but the conditions incident to overcrowding, bad air, and inhalation of dust lower the vitality and irritate the lungs, making them fruitful soil for infection. If all of these occupations could be carried on out-of-doors the high death rate from tuberculosis would be speedily lowered.

Low wages may be considered one of the most important indirect causes of loss of health in the working classes.

Poverty means overcrowding, filth, bad air, and insufficient food and clothing, all of which cannot be offset by sanitary occupation. Low wages also compel child labor and the woman of the family doing treble duty, in childbearing, housework, and wage earning two evils whose bad effects are felt by succeeding generations.

Location of occupation often makes the work sanitary or the reverse; a factory situated in the country or a small town with an abundance of sunlight and good air and the same factory situated in a crowded city, the workmen breathing foul air, soot, and dust, and working by artificial light, cannot be judged in the same way. Fortunately for the good of the nation, employers, legislators, and sanitarians are making a combined effort to improve the sanitary conditions surrounding all classes of workers.

In many states laws governing the air space, ventilation, lighting, heating, hours of labor, and employment of women and children in manufacturing industries, have done wonders in improving the condition of the laboring classes.

In classifying the occupations from the standpoint of hygiene, they may be divided into "(1) Those which are dangerous to health from the materials used; (2) Those which in themselves are harmless but are carried on under unsanitary conditions; (3) Those involving danger of injury; (4) Those which are dangerous neither to health nor life."[1]

1. *Those Occupations which are dangerous to Health from the Materials Used*

Irritating gases:

Ammonia.

Chlorine, from brick glazing and bleaching powder,

[1] Harrington's divisions.

causes catarrh, loss of sense of smell, bronchitis, asthma, and decay of teeth.

Hydrochloric acid, from alkali works and galvanizing iron, has the same effect as chlorine to a lesser degree.

Sulphur dioxide, from smelting and match works and in the manufacture of sulphuric acid, has no very serious effects and disturbs the digestion more than the breathing.

Nitrous fumes, from contact of nitric acid and metals, said to cause phthisis.

Poisonous gases and fumes:

Carbon monoxide, from many manufacturing operations, causes disturbances of the digestion and weakness both mental and physical.

Carbon disulphide, used to dissolve fats and in rubber works, causes headache, disordered vision, dizziness, and convulsions in the rubber workers; usually no permanent injury results.

Naphtha, used for garment cleaning, produces vomiting, headache, dizziness, and hysteria, symptoms sometimes persisting for several weeks.

Mercury, used in the manufacture of mirrors, thermometers, barometers, electric batteries, and felting, produces the usual symptoms of mercurial poisoning, fetid breath, soreness of teeth, and later a dark line at their upper margin, salivation.

Phosphorus, used in the manufacture of matches, may cause necrosis of jaw; occurs less frequently than formerly owing to improved machinery.

Arsenic, from smelting operations. The fumes of arsenic are less dangerous than dust containing arsenic.

Brass, in brass founding, produces "brass founder's ague."

Wood alcohol, fumes sometimes arising from varnish may cause temporary blindness.

Offensive gases and vapors arising from soap making, tanning, glue making, fertilizer making, bone boiling, and other offensive industries, have not been found injurious to workmen, nor to those persons living in the vicinity. New workmen often suffer from headache, nausea, and loss of appetite, but the symptoms soon disappear.

Poisonous dusts:

Arsenic, used in printing wall paper, cretonnes, artificial flowers (especially hazardous), and green glazed paper for box covers, causes eczema and ulcers, nausea with metallic taste, pain or soreness in abdomen, itching of eyelids, symptoms increasing.

Lead, one of the most common and disastrous of the industrial poisons, is taken both by inhalation and carried into the mouth by soiled fingers. Used in paper glazing, artificial flowers, painting, plumbing, printing, enameling, and in making china and other pottery. Causes paralysis of muscles of forearm called "wrist-drop," pallor, thirst, loss of appetite, fetid breath, emaciation, colic, and rheumatic pains. Frequently results in death.

Irritating dusts:

Metallic dust, from glass and steel grinding, gem polishing, stone work, mica dust. Pneumonia and phthisis are common among the workmen.

Vegetable dusts; dusts from cotton and linen are especially irritating and the workers generally unhealthy, phthisis being common. Carpenters do not suffer from wood dust, as they work out-of-doors, while cabinet workers indoors are subject to phthisis. Millers do not seem to suffer from grain dust. Tobacco dust causes nasal and bronchial catarrh with disturbances of digestion and nervous system. Abortion is said to be common with the women workers in tobacco.

Animal dusts, from wool, silk, fur, bristles, horn, ivory, bone, and hair are all more or less irritating. Wool is said to be less so than cotton or linen, while bone, ivory, and horn have the same effects as the metallic dusts.

Infective matter in dust, from rags, hides, wool, and horsehair. Especially dangerous from anthrax when workmen have any cuts or abrasions upon the hands, and from cholera, scarlet fever, smallpox, and other infectious diseases; "wool-sorter's" disease.

Exposure to heat, such as in the work of cooks, bakers, engineers, firemen, miners, workmen in rolling mills, glass factories, and many others, causes exhaustion. The sudden chilling of the body provokes catarrh, rheumatism, kidney, and skin diseases among these workmen.

Exposure to dampness indoors is detrimental to health, while workers out-of-doors, such as fishermen, sailors, and drivers, are usually healthy and long-lived.

Atmospheric Pressure. — Tunnel and bridge builders who work in caissons under water have a disease known as "caisson disease."

Restricted attitude in many trades causes deformities and is often a factor in causing phthisis.

2. *Those Occupations which in themselves are Harmless but are carried on under Unsanitary Conditions*

To this class belong all indoor work carried on under such bad conditions as overcrowding, lack of light and air, and uncleanliness. The work of a clerk in a shoe shop would hardly be considered a menace to health, but if the shop be in the basement of a department store, where low ceilings, overheating, artificial lighting, and overcrowding are continually present, the clerk would no doubt become pale, languid, and dull, besides having little resistance to any disease, and it is this loss of resistance (lowering of opsonic index) which renders this class of workers so liable to all diseases. Sewing could not be called an unhealthy occupation, but the dress-makers, tailors, and sweat-shop workers, who toil in crowded, dark rooms, are frequent victims of tuberculosis.

The list of such occupations might be carried on almost indefinitely and the conclusions be the same; viz., that it is not the work, but the conditions surrounding the worker both in the shop and home, the latter often as unsanitary as the former, which result in anæmia, dyspepsia, depressed spirits, and loss of resistance to all diseases.

3. *Occupations Involving Danger of Injury*

Miners, factory workers of all kinds, machinists, and railway employees, are exposed to greater danger to life and limb than those in other occupations. So enormous has become the loss of life and crippling of workmen in this country that a general awakening to the need of better protection for laborers is taking place.

Two exhibitions have been held, one in Philadelphia and one in Chicago, showing the dangerous conditions under which men, women, and children are employed, together with a large number of safety devices for their protection. The great number of accidents occurring upon all railways includes passengers as well as employees, and the better protection given to both passengers and workmen in European countries may be readily seen in the following statistics: in 1907, 647 persons were killed by railway accidents in the United States, 18 in France, 74 in Germany, and 119 in Great Britain. In the case of workmen killed, the majority are comparatively young, vigorous men, leaving young families unprovided for, which are in turn left to struggle with poverty and all of its necessary deprivations.

Doubtless another decade will see the enactment of many protective laws for this class of workmen.

4. *Occupations which are Dangerous neither to Life nor Health*

This class of occupation is too extended and too well known for enumeration here. Persons engaged in sedentary work frequently suffer from indigestion, insomnia, nervousness, and debility, but these are caused by lack of physical exercise to a great degree, and cannot be attributed to the occupation. The nervous and mental disturbances are usually from monotony.

Farmers' wives and many other women whose housework and childbearing keep them in a monotonous routine for years at a time are frequent victims of mental and nervous disorders. In these cases there is no lack of physical exercise, on the contrary too much, but there is lack of fresh air and often lack of proper food, as they are too exhausted to prepare food, or to eat if it is prepared, while many of them are deprived of any leisure or diversion.

Section II

The Employment of Women and Children. — The most serious problem of industrial hygiene is that of the employment of women and children. The consequences of long hours, confinement, and unsanitary conditions are far-reaching, the effects being seen in the second and third generations. It is within a hundred years that the first laws were enacted for the protection of women and children. That a law was necessary to restrict the working hours of children to *twelve* hours a day seems too monstrous to be possible, but little boys have worked that many hours *at night* in the glass factories of certain states in this country within the last two years.

The United States census of 1900 reports 500,000 children between the ages of ten and fourteen years who could neither read nor write, and were mostly employed in the cotton fields and mills of the South. Medical statistics upon the results of child-labor are extremely meager, although it does not require any great amount of intelligence to fully understand how disastrous to physical, mental, and moral health such work must be. Like many other questions the cruelty and immorality does not appeal to men, and adequate protection will never be given in all states until the harm from an economic standpoint is forced upon the nation. In another generation, when the country has need of every possible able-bodied man for workmen and soldiers, there will be an awakening to the evil effects of child-labor.[1]

The brief for the defendant, in case No. 107 of the Supreme Court of the United States, October, 1907, cites the testimony of many eminent authorities upon the necessity of restricting the hours of labor for women, also giving an account of the legislation enacted in many foreign countries as well as in our own states, from which the following is quoted: —

"The British law of 1844 was the first statute in any country limiting the hours of labor for adult women. It simply extended to women the provisions of the Act of 1833, which had restricted the work of children in textile mills to twelve hours per day. In 1847 the legal working time for women as well as children in textile mills was reduced to ten hours per day. By further

[1] References: Proceedings of the National Child Labor Committee. Report by the Commission on Industrial and Technical Education in Massachusetts. *School or Work?* issued by the Consumers League, Chicago. Report of the case, Curt Miller *v* State of Oregon, Supreme Court of the United States, October Term, 1907, No. 107. *The Woman Who Toils*, by Mrs. John Van Vorst and Miss Marie Van Vorst.

legislation in 1867, 1878, 1891, and 1901 further restrictions were introduced. The law, subject to certain exceptions allowing overtime, is in substance as follows (Law of 1901, 1 Edw. VII. ch. 22): —

"'*Hours.*

"'*Textile Factories.* (Sec. 24.)

"'The period of employment, except on Saturday, shall either begin at 6 A.M. and end at 6 P.M., or begin at 7 A.M. and end at 7 P.M.

"'There shall be allowed for meals during said period of employment on every day except Saturday not less than two hours, of which one hour at the least shall be before 3 P.M.

"'Special regulations for a shorter day on Saturdays.

"'*Non-textile Factories and Workshops.* (Sec. 26.)

"'The period of employment, except on Saturdays, shall either begin at 6 A.M. and end at 6 P.M., or begin at 7 A.M. and end at 7 P.M., or begin at 8 A.M. and end at 8 P.M.

"'There shall be allowed for meals during the said period of employment on every day except Saturday not less than one and one half hours, of which one hour at the least shall be before 3 P.M.

"'Special regulations for a shorter workday on Saturdays.

"'*In a Workshop which does not employ Children or Young People.* (Sec. 29.)

"'The period of employment shall, except on Saturdays, be a specified period of twelve hours taken between 6 A.M. and 10 P.M.

"'There shall be allowed to a woman for meals and absence from work during the period of employment not less than one and one half hours.'"

France, Switzerland, Austria, Holland, Italy, and Germany, all have laws restricting the hours, thirteen hours being the maximum granted and that only for "overtime" in special seasons, for not more than two weeks at one time, nor for more than forty days in one year. Spain has recently enacted a law forbidding the employment of women within four weeks after childbirth.

In the United States, "twenty States of the Union, including nearly all of those in which women are largely employed in factory or similar work, have found it necessary to take action for the protection of their health and safety and the public welfare, and have enacted laws limiting the hours of labor for adult women.

"This legislation has not been the result of sudden impulse or passing humor, — it has followed deliberate consideration, and been adopted in the face of much opposition. More than a generation has elapsed between the earliest and the latest of these acts.

"In no instance has any such law been repealed. Nearly every amendment in any law has been in the line of strengthening the law or further reducing the working time.

"The earliest statute in the United States which undertook to limit the hours of labor for women in mechanical or manufacturing establishments was Wisconsin Statute, 1867, ch. 83, which fixed the hours of labor as eight. The act, however, provided a penalty only in case of compelling a woman to work longer hours.

"The earliest act which effectively restricted the hours of labor for women was Massachusetts Statute, 1874, ch. 34, which fixed the limit at ten hours. The passage of the Massachusetts Act was preceded by prolonged agitation and repeated official investigations. The first legislative inquiry was made as early as 1865.

"After the Massachusetts Act had been in force six years, an elaborate investigation of its economic effects was undertaken by the Massachusetts Bureau of Labor Statistics, under the supervision of its chief, Mr. Carroll D. Wright. His report, published in 1881 (Twelfth Annual Report of the Massachusetts Bureau of Statistics of Labor), to the effect that the reduction of the hours of labor had not resulted in increasing the cost or reducing wages, led to the passage, in 1885 and 1887, of the ten hour law for women in Rhode Island, Maine, New Hampshire, and Connecticut, and largely influenced the legislation in other States.

"In the United States, as in foreign countries, there has been a general movement to strengthen and to extend the operation of these laws."

"THE DANGERS OF LONG HOURS

"PHYSICAL DIFFERENCES BETWEEN MEN AND WOMEN

"The dangers of long hours for women arise from their special physical organization taken in connection with the strain incident to factory and similar work.

"Long hours of labor are dangerous for women primarily because of their special physical organization. In structure and function women are differentiated from men. Besides these anatomical and physiological differences, physicians are agreed that women are fundamentally weaker than men in all that makes for endurance: in muscular strength, in nervous energy, in the powers of persistent attention and application. Overwork, therefore, which strains endurance to the utmost, is more disastrous to the health of women than of men, and entails upon them more lasting injury."

Report of Select Committee on Shops Early Closing Bill, British House of Commons, 1895

Dr. Percy Kidd, physician in Brompton and London Hospitals: —

"The most common effect I have noticed of the long hours is general deterioration of health; very general symptoms which we medically attribute to overaction, and debility of the nervous system; that includes a great deal more than what is called nervous disease, such as indigestion, constipation, a general slackness, and a great many other indefinite symptoms.

"Are those symptoms more marked in women than in men?

"I think they are much more marked in women. I should say one sees a great many more women of this class than men; but I have seen precisely the same symptoms in men, I should not say in the same proportion, because one has not been able to make anything like a statistical inquiry. There are other symptoms, but I mention those as being the most common. Another symptom especially among women is anæmia, bloodlessness or pallor, that I have no doubt is connected with long hours indoors." (Page 215.)

Hygiene of Occupation, in Reference Handbook of the Medical Sciences. George M. Price, M.D., *Medical Sanitary Inspector, Health Department of the City of New York.* Vol. VI

"In many industries . . . female labor is very largely employed; and the effect of work on them is very detrimental to health. The injurious influences of female labor are due to the following factors: (1) The comparative physical weakness of the female organism; (2) The greater predisposition to harmful and poisonous elements in the trades; (3) The periodical semi-pathological state of health of women; (4) The effect of labor on the reproductive organs; and (5) The effects on the offspring. As the muscular organism of woman is less developed than that of man, it is evident that those industrial occupations which require intense, constant, and prolonged muscular efforts must become highly detrimental to their health. This is shown in the general debility, anæmia, chlorosis, and lack of tone in most women who are compelled to work in factories and in shops for long periods.

"The increased susceptibility of women to industrial poisons and to diseases has been demonstrated by a great number of observers. The female organism, especially when young, offers very little resistance to the inroads of disease and to the various dangerous elements of certain trades. Hirt says, 'It must be conceded that certain trades affect women a great deal more injuriously than men;' and he mentions, among others, the effects of lead, mercury, phosphorus, and other poisons. Even where there are no special noxious elements, work may produce, as already mentioned, harmful effects on the health of women; but when to the general effects of industrial occupation are added the dangers of dust, fumes, and gases, we find that the female organism succumbs very readily, as compared with that of the male. Schuler found the frequency of sickness in females under eighteen, as compared with that of men of the same age is as 174 to 100. Miss Mary E. Abrams (Oliver, *Dangerous Trades*) found that out of 138 lead-poisoning cases in Newcastle, where the number of men and women workers was about the same, there were ninety-four cases among the women and forty-one among the men. She also found that out of the twenty-three deaths from plumbism in the years 1889–1892, twenty-two were women and only one was a man. The women were all between seventeen and thirty years of age. These figures are substantiated by Hirt, Arlidge, C. Paul, Tardien, and others. The predisposition of women in industrial occupations to disease in general is greater than it is in men, as was proven by Hirt in his statistics of tuberculosis among workers. The effect of work on the physical development of women was found to be very detrimental, especially when they were very young. Arlidge says that in those who from their youth work in high temperatures, the bones and joints are imperfectly developed, and that they are liable to female deformities and to narrow pelves. Herkner found in his studies of Belgian female workers that girls who are engaged in mines suffered from deformed joints, from deformities of the spinal column, and from narrow pelves.

"It has been estimated that out of every one hundred days women are in a semi-pathological state of health for from fourteen to sixteen days. The natural congestion of the pelvic organs during menstruation is augmented and favored by work on sewing-machines and other industrial occupations necessitating the constant use of the lower part of the body. Work during these periods tends to induce chronic congestion of the uterus and appendages, and dysmenorrhœa and flexion of the uterus are well known affections of working girls. (Page 321.)

Effects of the Factory System. By Allen Clarke. *London,* 1899

"Greater speed of improved machinery, whereby the work is increased six-fold, resulting in physical deterioration and mental worry. (Page 41.)

"The toil is ceaseless; the machinery demands constant watching. . . . Their feet are never still; their hands are full of tasks; their eyes are always on the watch; they toil in an unending strain that is cruel on the nerves. (Page 49.)

"And all these hours — ten hours a day — spinner and weaver are on their feet; no sitting down; no resting; one must keep up to the machinery though agonized with headache or troubled by any other complaint. While the engine runs the workers must stand." (Page 51.)

Report of the United States Industrial Commission, 1900

"Mrs. Robertson tells me that when she was a girl, to run one or two looms was as much as any woman would have tried. Now, in some instances, there are women running nine looms, and the looms have more than doubled or trebled their speed. This means more work and harder work." (Page 63.)

Report of the United States Industrial Commission, 1901

"It is brought out that in nearly all occupations an increasing strain and intensity of labor is required by modern methods of production. . . . The introduction of machinery and the division of labor have made it possible to increase greatly the speed of the individual workman. . . . The testimony of a representative of the Cotton Weavers' Association shows this increasing strain of work. He says: —

"'Anybody who works in the mills now knows it is not like what it was twenty-five or thirty years ago, because the speed of the machinery has been increased to such an extent, and they have to keep up with it.' (Page 763.)

"Even these cases where machinery has not increased the intensity of exertion, a long workday with the machine, especially where work is greatly specialized, in many cases reduces the grade of intelligence. The old handwork shops were schools of debate and discussion, and they are so at the present time where they survive in country districts; but the factory imposes silence and discipline for all except the highest. Long workdays under such conditions tend to inertia and dissipation when the day's work is done." (Page 772.)

Massachusetts Bureau of Statistics of Labor. Domestic Labor and Woman's Work, 1872

"In the cotton mills at Fitchburg the women and children are pale, crooked, and sickly-looking. The women appear dispirited, and the children without the bloom of childhood in their cheeks, or the elasticity that belongs to that age. Hours, 60 to 67¾ a week." (Page 94.)

Age and Sex in Occupations. Twentieth Century Practice of Medicine, 1895, Vol. III. *By* Dr. James H. Lloyd.

"Woman may suffer in health in various ways that do not affect materially her mortality — neurasthenia, the bane of overworked and underfed women, does not leave a definite trace on the mortality tables.

"Again, woman's ill-health and drudgery in a factory may affect her progeny in a way that the statistician cannot estimate. (Page 326.)

"Women are said to suffer from derangements and displacements from occupations requiring long standing and certain movements of the body, while the lacteal secretion is impaired by some occupations, and also by enforced absence of mothers from their nursing infants. (Page 327.)

"Neurasthenia from overwork. . . . It cannot be ignored, because among its well recognized and active causes is the strain of excessive labor. (Page 488.)

"I have been struck . . . with the numerous facts that have come to my notice tending to convince me that one of the most common effects of overwork and poor hygiene in industrial life is an ill-defined condition of neurasthenia, insomnia, headache, and pains in and along the spine . . . extreme lassitude and weakness occur.

"The treatment of neurasthenia from overwork should be first by removing or modifying the cause as much as possible." (Page 490.)

Report to the Local Governing Board on Proposed Changes in Hours and Ages of Employment in Textile Factories, by J. H. Bridges, M.D., *and* T. Holmes. *British Parliamentary Papers,* 1873. Vol. LV. (Page 39.)

"Experience afforded by residence in the worsted manufacturing town of Bradford, and extensive practice among its population during periods of from one to thirty-five years:—

"*A*. Amongst the *women* of factory operatives, much more than among the general population, derangements of the digestive organs are common, *e.g.*, pyrosis, sickness, constipation, vertigo, and headache, generated by neglect of the calls of nature through the early hours of work, the short intervals at meals, the eating and drinking of easily prepared foods, as bread, tea, and coffee, and the neglect of meat and fresh cooked vegetables. Other deranged states of a still worse character are present, *e.g.* leucorrhœa and too frequent and profuse menstruation. Cases also of displacement, flexions, and versions of the uterus, arising from the constant standing and the increased heat of and confinement in the mill. . . . Œdema and varicose veins of the legs are common amongst female mill-workers of middle age.

"*Q.* Has the labor any tendency to increase the rate of infant mortality?

"*A.* Yes. The evils occurring in women as detailed in answer to question 2 indirectly affect the more perfect growth of the child in utero, and dispose it when born more easily to become diseased.

"Signed on behalf of the Bradford Medico Chirurgical Society, at a meeting held February 4, 1873.

"Sub-Committee.

"*President,* J. H. Bell, M.D.

"P. E. Miall, M.R.C.S.

"*Secretary,* David Goyder, M.D."

Report of the British Chief Inspector of Factories and Workshops, 1873. Dr. R. H. Leach, *Certifying Surgeon for over Thirty Years.*

"Shorten their hours of labor, for I believe that scores of infants are annually lost under the present system. As things now stand, a mother leaves her infant (say of two months old) at 6 A.M., often asleep in bed, at 8 she nurses it, then until 12.30 the child is bottle fed, or stuffed with indigestible food. On her return at noon, overheated and exhausted, her milk is unfit for the child's nourishment, and this state of things is again repeated until 6 P.M.; the consequence is, that the child suffers from spasmodic diarrhœa, often complicated with convulsions and ending in death."

La Réglementation Légale du Travail des Femmes et des Enfants dans l'Industrie Italienne. Lionel Baudoin.

"At the International Congress at Milan, on accidents among the laboring class, in May, 1894, Mr. Luigi Belloc (Factory Inspector of the Department of Labor) represented Italy. He stated that the continuous motion of the body taxes the nervous system, causing the gravest troubles. The sewing-machine, which requires of the operator 40,000 movements a day, causes in the long run abdominal and renal troubles, disarrangement of the menstrual function, and falling and deviations of the uterus. Functional weaknesses and paralysis are the result of the continual performance of the same movement. The necessity of standing or sitting for the whole day causes malformation of the body or curvature of the spine, as a result of the strained position. The attention required in watching a machine, especially an automatic one, is very fatiguing, on account of the large number of wheels operating at the same time which need attention.

"Women employed in the manufacture of tobacco and of matches are subject to gastric, intestinal troubles, and affections of the respiratory tract, necrosis of the jaw, and are liable to miscarriage. Women employed in sorting rags used in the manufacture of paper are liable to smallpox or carbuncle. Tuberculosis spreads with alarming rapidity, especially among cotton and wool weavers. Those whom tuberculosis spares drag along with anæmia, the most common malady of the women factory workers, especially the textile workers, who are subject to long hours of labor. . . .

"For the cotton industry in particular Mr. Luigi Belloc demands the ten-hour day." (Page 14.)

Infant Mortality: A Social Problem. Geo. Newman, M.D., *London,* 1906.

"Physical fatigue, particularly if accompanied by a strain and stress, are likely to exert a decided effect in the production of premature birth, particularly if these conditions are accompanied by long hours of work and poor or insufficient nourishment." (Page 80.)

Report of the German Imperial Factory Inspectors, 1895.

"The ten-hour day, with the exceptions necessary for certain trades, is a measure which can be introduced without great difficulty, and which would prevent many dangers threatening the health of workers. Many accidents are no doubt due to the relaxed vigilance and lessening of bodily strength following excessive hours of work." (Page 369.)

Report of the British Chief Inspector of Factories and Workshops, 1900.

"One can only feel surprise that accidents are not more numerous (in laundries), when one realizes that the slightest carelessness or inattention may result in the fingers or hand being drawn between the hot cylinders, and when one considers how easily such inattention may arise in the case of the overtired young workers." (Page 383.)

Report of British Chief Inspector of Factories and Workshops, 1903.

"The comparative immunity from accidents in the laundries in the West Riding of Yorkshire may be possibly due in some measure to the moderate hours of employment.

"The incidence of accidents according to time of day is somewhat surprising, the most dangerous hours apparently being 11 A.M. to 12 noon and 4 to 6 P.M. . . . Probably 11 A.M. to 12 noon is more generally than any other time the last tiring hour of a five hours' spell; 4–6 P.M. covers the time when most generally the transition is from daylight to artificial light." (Page 210.)

"Reference was also made (in the Thirteenth International Congress of Hygiene), although figures were not adduced, to the alleged increase in the number of accidents which occur late in the working-day when the effect of intellectual and physical fatigue have made themselves apparent." (Page 298.)

Massachusetts Legislative Document. House, 1866, No. 98.

"Overwork is the fruitful source of innumerable evils. Ten and eleven hours daily of hard labor are more than the human system can bear, save in a few exceptional cases. . . . It cripples the body, ruins health, shortens life. It stunts the mind, gives no time for culture, no opportunity for reading, study, or mental improvement. It leaves the system jaded and worn, with no ability to study. . . . It tends to dissipation in various forms.

The exhausted system craves stimulants. This opens the door to other indulgences, from which flow not only the degeneracy of individuals, but the degeneracy of the race." (Page 24.)

Relations between Labor and Capital. U.S. Senate Committee, 1883. Vol. I. *Testimony of* Robert Howard, *Mule-Spinner in Fall River Cotton Mills.*

"I have noticed that the hard, slavish overwork is driving those girls into the saloons, after they leave the mills evenings . . . good, respectable girls, but they come out so tired and so thirsty and so exhausted . . . from working along steadily from hour to hour and breathing the noxious effluvia from the grease and other ingredients used in the mill.

"Wherever you go . . . near the abodes of people who are overworked, you will always find the sign of the rum-shop.

"Drinking is most prevalent among working people where the hours of labor are long." (Page 647.)

President Roosevelt's Annual Message delivered to Second Session of 59th Congress. December 4, 1906.

"More and more our people are growing to recognize the fact that the questions which are not merely of industrial but of social importance outweigh all others; and these two questions (labor of women and children) most emphatically come in the category of those which affect in the most far-reaching way the home life of the Nation.

The Working Hours of Female Factory-hands. From the Reports of Factory Inspectors, collated in the Imperial Home Office. Published by Von Decker. *Berlin,* 1905.

"The inspector for Breslau says, 'The reduction of the working-day to ten hours is such a decided step in advance, and is of such marked and wholesome influence on the mental, physical, and moral status of the entire working population, that its introduction should be emphatically urged.'

"The inspector for Cologne says, 'The reduction of the working-day for all women over sixteen years must be regarded as a necessity for both moral and hygienic reasons.'

"The inspector for Hanover says, 'The reasons for the reduction of the working-day to ten hours —

(*a*) The physical organization of woman,
(*b*) Her maternal functions,
(*c*) The rearing and education of the children,
(*d*) The maintenance of the home —

are all so important and so far reaching that the need for such reduction need hardly be discussed.'

"Another inspector says, 'Considering the detrimental physical effects of factory work, its nerve-exhausting character, its ruinous influence on family life and the care of children, and, indeed, under all the aspects of the physical, moral, and mental development of the working class, the reduction of the legal working-day for women must be regarded as an emphatic demand

and a moral obligation, whose introduction must be urged after a careful and conscientious weighing of all the reasons for and against it.'" (Page 106.)

Report of the Washington Bureau of Labor Statistics,
1905–1906.

"The present law prohibits the employment of any female worker for a longer period than ten hours in any one calendar day. Splendid results have been obtained through the operation of this law, for much as one may dislike to credit it, there are employers who would insist upon working their female help from twelve to sixteen hours per day did the law not stand in their way."

These extended quotations have been made to illustrate how widespread are the evils resulting from the employment of women in the industries, knowledge of which many women entirely lack.

Nurses in public hospitals and visiting nurses are frequently brought in contact with the unfortunate victims, and should understand that not only the individual, but the nation, suffers from their loss of health.

CHAPTER XI

DISINFECTION

Besides the sanitary measures taken for the prevention of disease, certain agents are employed for the destruction of the bacteria of specific diseases, to limit the spreading of infectious diseases. These agents are known as disinfectants and antiseptics.

Disinfectants are divided into three classes: light, heat, and chemicals.

Light. — The direct rays of the sun are powerfully disinfectant; sunlight destroys or retards the growth of many disease organisms, while diffused daylight and electric light are much less effective. The bacilli of tuberculosis has been destroyed by direct sunlight in from a few minutes to a few hours; typhoid fever bacilli, anthrax spores, and cholera bacilli are also destroyed by sunlight.

This germicidal effect of sunlight should be appreciated in the location of houses and the arrangement of windows, as well as in the care of the house, which should daily utilize the sunlight to render the habitation wholesome.

The exposure of bed clothing to the sun and air is rarely done in many households, blankets and mattresses are used for weeks and months at a time without a ray of sunlight touching them; and when rugs, draperies, upholstered furniture, cushions, etc., are added to the bedding, the wonder is, not that epidemics prevail, but that they ever cease.

Sunlight has a sterilizing effect on the bacteria contained in drinking-water and sewage. The practical use of sunlight must necessarily be mostly in the prevention of disease, as it is not available at all times nor in all places; it might, however, be used much more in disinfecting furniture after infectious diseases, especially in small towns or the country, where it is feasible to expose the furnishings of an entire house to the rays of the sun. For generations it has been a country custom to expose all utensils used for milk to the rays of the sun. The originators of the practice were doubtless ignorant of the principle involved, but their observation taught them the advantages to be derived.

Heat. — Disinfection by means of dry or moist heat is often employed. Dry heat is less effective than moist heat, besides being destructive to many fabrics. Moist heat in the form of steam under pressure or boiling water may be used much more effectively and practically than dry heat. The first known practical application of steam for disinfection was that made by Dr. A. N. Bell of the United States Navy, upon two ships infected with yellow fever during the Mexican War in 1848, but during the past twenty years a large number of steam sterilizers, both portable and stationary, have been devised for the disinfection of all kinds of water, clothing, bedding, carpets, surgical instruments, utensils, suture material and dressings, and the mails. Many cities and towns are provided with sterilizers for public use, while all hospitals are equipped with several for use in the different departments.[1]

Boiling Water. — Many articles such as surgical instruments, dishes, and washable clothing, except woolens, may be easily disinfected by boiling for half an hour.

Cold is an antiseptic but not a disinfectant, the difference being that an antiseptic limits or retards the growth of bacteria but does not always kill them, while a disinfectant destroys them completely.

The typhoid bacillus, it is said, will survive 100 days of freezing, and cholera germs also will withstand several days of freezing, while an instance is recorded of diphtheria bacilli being frozen for four months, with the survival of a few.

Chemical Disinfectants. — The list of chemical disinfectants is too extensive to be given in full here, and no attempt will be made to describe any but those in common use in households and hospitals.

Formulæ and directions for their use are found in all standard text-books on nursing, and need not therefore be repeated here.

Chloride of lime is a common household disinfectant which is used in solid form for disinfecting privy vaults and cesspools, or in solution for drains, cellars, and woodwork, and for disinfecting urine and feces. A very weak solution is sometimes used for the disinfection of clothing, which it also bleaches, but its action is destructive to all fabrics. The value of chloride of lime as a disinfectant is disputed.

[1] TEACHER'S NOTE. — Pupils should be taken to the sterilizing rooms, and the mechanism and purpose of sterilizers of all kinds should be carefully explained to them.

Lime is one of the oldest disinfectants known; its use for sanitary purposes was obligatory with the Children of Israel during their wanderings. Mixed with water to the consistency of cream, it is an excellent disinfectant for excreta and privy vaults. By the addition of more water it is commonly known as whitewash and is the best practical disinfectant for cellars or rough walls of any kind in houses, barracks, stables, poultry houses, and other outbuildings.

It is said that Lister's first observation upon cleanliness as a factor in surgery was, that after each whitewashing of the hospital wards, the number of cases of erysipelas and suppuration diminished for a short time.

Sulphur is another disinfectant which has been used nearly or quite as long as lime, although of late years it has been demonstrated that sulphur is of little value as a disinfectant.

Sulphur dioxide is produced by burning the sulphur, the process for disinfection being commonly known as sulphur fumigation. The best sanitary authorities believe however that sulphur fumigation without the addition of moisture is worthless, while with moisture its value is very limited. Its chief value is in destroying mosquitoes and bedbugs. In old buildings infested with bedbugs, repeated fumigations with sulphur at short intervals will destroy them.

The fumes of sulphur tarnish all metals and discolor most fabrics, also leaving a disagreeable odor, which persists for many days.

Permanganate of potassium is a disinfectant quite extensively used for the hands in surgical work, but it is not practical for the disinfection of excreta, and it stains all fabrics permanently.

Sulphate of copper is an effective germicide, but too expensive for practical purposes.

Bichloride of mercury (corrosive sublimate) is probably the most important chemical disinfectant known, but Harrington says, "it enjoys a reputation for practical efficiency that is not wholly deserved." Its especial value is in surgical work for disinfecting the skin, ligatures, and utensils. It corrodes metals and therefore cannot be used upon surgical instruments.

Experiments have demonstrated that the failures of disinfection by bichloride of mercury have been largely due to haste. Walker states that "Corrosive sublimate in as weak solution as 1 : 5000 is ineffective against the common pathogenic bacteria including pus organisms when they are moist *excepting after prolonged contact*. . . . The mere dipping of hands (or utensils) for a few seconds into solutions of this strength (1 : 1000) can serve no useful purpose, but, on the contrary, can lead to much harm by inducing a false sense of security."

The mineral acids are disinfectants against all bacteria, but corrode all metals and destroy fabrics.

Hydrochloric acid, which is the acid contained in the gastric juice, has been found effective in destroying both the cholera and typhoid fever bacilli.

Sulphuric acid also is effective with cholera and typhoid fever germs, but neither is of any value for disinfecting in cases of tuberculosis or diphtheria; neither acid therefore is practical for general use.

Carbolic acid (phenol), one of the best-known and commonly used disinfectants, is a substance obtained from coal tar. According to some of the best authorities the crude acid is a better disinfectant than the more refined grades, because it contains a higher percentage of the cresols. Authorities differ greatly in their estimate of the value of carbolic acid as a disinfectant, but it is conceded to have some qualities preferable to corrosive sublimate; it does not corrode metals, and even in a weak solution it kills many pathogenic bacteria.

It is probably more effective in destroying the bacilli of tuberculosis than for the organisms of typhoid fever or diphtheria. Its germicidal power is said to be greatly increased by heat. Heider records that "a 5 per cent solution at ordinary room temperature was not effective against anthrax spores in 36 days, while at 55° C. (131° F.) it was successful in 2 hours and at 75° C. (167° F.) in 3 minutes."

The cresols are substances contained in carbolic acid, and of recent years have been extensively used in various preparations, the most common being *creolin*, *crenosol*, and *lysol*, all of which are used satisfactorily in surgical work.

Alcohol is much used as a disinfectant in surgical work, and as a preservative of organic substances.

Soaps of all kinds are disinfectant and antiseptic. It has been demonstrated that a 10 per cent solution of good soap would destroy the bacilli of typhoid fever, a stronger solution being necessary for cholera bacilli, while for the pus cocci (germs) it was entirely ineffective with a 20 per cent solution. For practical purposes, however, soap could not be the sole disinfectant used upon the bed and body linen of typhoid fever or cholera patients, as the ordinary procedure in hospital laundries would not insure certain results, and again such linen must be wet with some disinfectant immediately upon its removal from the bed, not only as a protection to nurses and others who must necessarily handle it, but to prevent any pathogenic bacteria from becoming dried and blown about.

The tincture of green soap is used almost exclusively in all hospitals for sterilizing the hands or the field of operation, as it is conceded to be the best soap known for the purpose.

The value of soap in the process of room or household disinfection is not wholly realized.

In the disinfection of woodwork and furniture, soap may be used where corrosive sublimate, carbolic acid, and many other disinfectants would be destructive to the fabric or finish. One factor in the use of soap which nurses and housekeepers recognize, is that it dissolves and *removes* the accumulated dirt upon the surfaces of objects, an office which corrosive sublimate and other disinfectants do not perform.

The furniture contained in living and bed rooms by constant handling and the accumulation of dust and soot becomes very dirty in a short time. By the use of a strong, warm soapsuds (20 per cent), and the addition of an ounce of petroleum to each gallon, the finest mahogany or rosewood surfaces may be washed with no injury to the polish, and an astonishing amount of dirt be removed, which would appear to be a much more effective disinfection than simply wiping the surfaces with a cloth, damp with a weak solution of some disinfectant.

The addition of an ounce of washing soda to each gallon of *hot* soapsuds used upon floors after an infectious illness or in the case of very dirty wooden floors will also remove as well as disinfect the filth, which is the desired end in view.

The very noticeable escape from infection which the hospital scrub-maids seem to enjoy, would certainly tend to confirm the claims of soap as a disinfectant.

Many medicated soaps upon the market claim great disinfectant powers, but the best authorities do not find them of any greater value as disinfectants than the ordinary soaps.

Abbott gives a formula for a Carbol-soap which is easily made and used and of great value for the disinfection of bed and body linen.

"Dissolve 3 parts green soap in
100 parts of warm water, add
5 parts commercial carbolic acid, stirring slowly.

"This forms a permanent solution and has about the same disinfectant value as the pure carbolic acid."

Formaldehyde is a gas which dissolved in water gives a solution of about 40 per cent formaldehyde, called formalin.

Formalin is the form most commonly used for disinfecting purposes.

Formaldehyde is considered the most valuable known disinfectant for room disinfection following all infectious diseases; it is also a deodorizer; it does not tarnish metals nor discolor fabrics; the gas is not poisonous, but is extremely irritating.

In fumigating with formaldehyde all cracks and crevices must be closed as in sulphur fumigation. There are several especially designed lamps and generators in use, the principle of all being to liberate the gas by heat.

The simplest method is a vessel into which formalin and permanganate of potassium are put, the mixture causing the liberation of an immense volume of gas.

For each 1000 cubic feet of space at 60° F. use
Formaldehyde 40 per cent 16 ounces,
Potassium permanganate 6¾ ounces.

The vessel should allow not less than 12 quarts for this amount. This process has the advantage of being easily multiplied for large spaces, which is not the case with single lamps or generators.

The formaldehyde should not be added until the last moment before leaving and sealing the room. When it is impossible to leave a room open for twenty-four hours after fumigation with formaldehyde, the odor may be quickly removed by placing a shallow vessel (platter) filled with aqua ammonia in the room.

Disinfection of Infective Materials.

Excreta: Carbolic acid 5 per cent;
or Chloride of lime 2 per cent;
or Milk of lime (lime and water, consistency of cream);
or Bichloride of mercury 1 ounce,
Hydrochloric acid 10 ounces,
Water 1 gallon.

In all cases the disinfecting solution should equal the excreta in bulk, and the mixture closely covered be allowed to stand some time before emptying.

All vessels used for stools, sputum, and vomit should be washed in carbolic acid 5 per cent, followed by scrubbing in hot soapsuds and by boiling in soda solution 3 per cent.

Clothing. — Bed and body linen, towels, napkins, wash curtains, bureau and stand covers; soak in cold Carbol-soap solution (p. 195) for two hours, rinse in clear cold water, and put into the laundry.

Woolen garments, unless badly infected, may be fumigated with formaldehyde, followed by exposure to sunlight. Otherwise heavy garments, carpets, rugs, furs, woolen curtains, together with children's playthings and books, should be put into compact bundles wrapped in cloths wet in carbolic acid 5 per cent or bichloride of mercury 1:1000, and burned in a furnace.

Utensils. — Dishes and silver may be boiled for 20 minutes in soda solution 5 per cent, also wash-basins and other toilet dishes, besides all surgical instruments, nail files, and manicure scissors.

Toothbrushes should not be used during infectious illness, but the mouth and teeth cleaned with small mouth sponges and toothpicks wrapped with absorbent cotton, both to be burned immediately.

Furniture. — 1. Fumigation with formaldehyde.

2. Wipe with cloth wet in carbolic acid 5 per cent followed by washing with a 20 per cent warm soapsuds containing 1 ounce of petroleum to each gallon.

3. Expose to sunlight for several days in suc-

cession if possible, turning all sides to the sun; turn upside down as well.

Walls. — 1. If papered, wet *thoroughly* with bichloride of mercury solution, 1 : 1000, remove paper, being very careful to keep the paper wet.

2. Fumigate the room and follow by opening all windows and doors for twenty-four hours.

Floors. — 1. Wet with bichloride of mercury solution 1 : 1000 before fumigation.

2. After fumigation, scrub with 20 per cent *hot* soapsuds to which has been added 1 ounce of washing soda to each gallon. This first cleaning should be done with a broom and mop that the water may be as near boiling as is possible.

Woodwork. — 1. Wet with bichloride of mercury 1 : 1000 before fumigation.

2. After fumigation, wash as directed for furniture.

In several cities laws have been enacted requiring public libraries and conveyances to be disinfected, and in some cities barber shops are under inspection regarding their daily care.

Teacher's Note. — For further directions for disinfecting sick room, patient, and nurse see *Primary Nursing Technique*, McIsaac, Chapter XII.

CHAPTER XII

QUARANTINE

Dr. Walter Wyman of the United States Marine Hospital Service defines quarantine as "the adoption of restrictive measures to prevent the introduction of diseases from one country or locality into another."

The term is broadly used, and by usage includes port, land, interstate, municipal, railroad, house, and room quarantine.

The necessity for restrictions in certain diseases has been recognized from the earliest times, leprosy probably being the first disease for which isolation in any sense was practiced.

The first maritime or port quarantine was established in 1403 in Venice, and all ships and persons coming from Egypt or other countries, suffering from the plague, were detained for forty days in quarantine; this practice gradually extended until it was realized that such wholesale arbitrary measures were unreasonable and imposed so much injury upon commerce that more rational restrictions were gradually made.

The United States government maintains quarantine stations at twenty-eight seaports. "Maritime quarantine consists of the detention of the infected ship, the isolation of the sick in a special hospital at the quarantine station, the disinfection of the ship and its cargo as well as the clothing and bedding of the well, the de tention of all well persons in barracks until after the period of incubation of the particular disease has elapsed and all danger of dissemination has been eliminated. The period of detention, the mode of disinfection, as well as all the other prophylactic measures employed, will depend entirely upon the character of the disease, its period of incubation, and the nature of the ship's cargo. The disinfecting agents commonly employed are superheated steam and formaldehyde." (Bergey.)

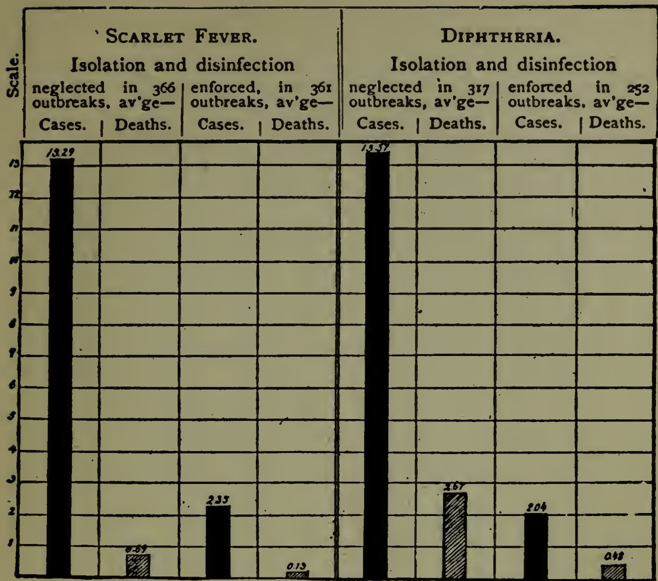
Inland quarantine is used in time of epidemics in certain localities, as in the case of yellow fever in the Southern states. When an epidemic extends over a number of states the quarantine becomes interstate and is under the jurisdiction of the United States Treasury department, which obviates the confusion which might arise from conflicting laws in the various states.

House quarantine is employed against smallpox, scarlet fever, diphtheria, cholera, typhoid and typhus fevers, yellow fever, and leprosy.

The patient should be isolated from the rest of the family, and other persons residing in the house should be forbidden attending school or business, or entering any public assembly or conveyance.

None but those in charge of the patient should be allowed to enter the house, and the board of health is required to placard the house, the placard to remain until the patient has recovered or died and the house has been disinfected.

The following table reproduced from the proceedings of the Michigan state board of health is convincing proof of the value of isolation and disinfection:—



Each state has a right to quarantine, but the Federal government may assume control when the quarantine interferes with interstate commerce.

The board of health of each state not only enacts regulations for quarantine in case of infectious diseases, but for controlling all conditions which may be detrimental to the public health, such as the disposal of garbage, sewage, the regulation of slaughterhouses, burial of the dead, and pollution of water by refuse from manufacturing.[1]

The disposal of the dead is accomplished by burial or cremation, the laws varying little in the various states.

[1] Teacher's Note. — Copies of the laws and regulations of the state and city boards of health should be posted in the nurses' classrooms.

INDEX

Printed in the United States of America.